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Civil Engineering.

Facts and Observations on Four and Six Wheel Engines.

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[CONTINUED FROM PAGE 20.]

Hull and Selby Railway.

By some means, the documents from which the following account is drawn, have for several weeks been overlooked.

After leaving the Manchester and Leeds Railway, I bent my course towards Hull. I have in another place, made a few observations on this railway, which, therefore, I have no necessity to repeat here.

Generally, this line is laid upon *kyanized longitudinal bearings*, but in one or two places there are cross-sleepers. The rails upon the longitudinal bearings are 44 lbs., but I did not learn what they were upon the cross-sleepers; I think about 70 or 75 lbs.

I asked Mr. Gray, the ingenious superintendent of the locomotives, how the kyanizing succeeded, and he told me he understood very well. I was anxious to know this, as I had upon another line heard some whispers against it.

I left Leeds on Monday, Nov. 29, for the purpose of proceeding to Hull, on the *Ariel* engine, which is fitted with Gray's patent expansive apparatus. This is an apparatus for cutting off the steam at almost any part of the stroke one desires, and changing that part at pleasure, by which means the engine may be adapted to almost any power required, and any velocity. Of this very ingenious invention, I shall say more hereafter, the inventor, Mr. John Gray—the gentleman before mentioned as the locomotive superintendent of the Hull and Selby line—having kindly presented me with a brass model to explain what my natural dulness did not permit me readily to comprehend,

when I was with him at Hull. Meanwhile I may mention, that there seems among the engineers to whom I have spoken about the invention, to be but one opinion as to its economical utility, and what has been not a little gratifying to my personal vanity, they have admitted that, though they were satisfied with the efficiency of the invention, they found great difficulty in learning its *modus operandi*, which proves that the heads of some of the engineers are as dull as mine.

The *Ariel* engine, I believe, belongs to the York and North Midland Company, and being made for a gauge of 4 feet 8½ inches, and, I think, rather loose in her axles, she appeared to be very unsteady, and twisted about much in going over that part of the North Midland Railway, from Leeds, which has a 4 feet 9 inch gauge, but afterwards she improved. Upon the *Ariel* I rode to the junction of the York and North Midland with the Leeds and Selby Railway, and then got upon the *Wellington*, of course a York and North Midland engine, as the Company leases the Leeds and Selby line. She was a very steady engine.

What this Leeds and Selby line was, I am unable to say, but it appears now to be a substantial and good line, having very nearly the character of the Hull and Selby Railway, which is a continuation of it; but if I recollect aright, for I did not take a note of it, the rails of the Leeds and Selby are laid upon stone blocks.

At Selby I got upon the *Liverpool*, one of the Hull and Selby Company's engines—another fitted with Gray's expansive apparatus. Both the *Ariel* and the *Liverpool* were six wheel engines, and had 6 feet driving wheels, and 2 feet stroke, a proportion to which, Mr. Gray is, for some reason unknown to me, much attached; the former worked at 70 lbs. pressure, and the latter at 75. The *Liverpool* appeared to me to be a good engine, and performed well. I was informed that both she and the *Ariel* consumed but 18 lbs. of coke to the mile.

But to return to our engine and the driver; poor fellow, he had the misfortune to stammer, and had much difficulty, amid the noise of the air and engine, to make me understand him. However, if he had difficulty here, he was resolved to convince me that with Gray's apparatus, his engine had none of her motions. He flew along at a rapid rate, and as the road was so straight, and the engine a steady one, I considered my neck—to the safety of which I am rather attached—in no danger, and therefore enjoyed it very much.

This man spoke in the warmest terms of Gray's machinery, and, certainly, from what I saw him do with the engine, it manifested great capability. On my remarking, at one time, upon the power of the engine, he rejoined, "Yes, sir, and I can snap that coupling (that between the engine and the tender) at any time. Shall I do it now? I will if I shall." I have no doubt that he would, but as I imagined there might be a possibility at the same time of uncoupling me from the engine, and bringing me into closer contact with the ground, and perhaps with the wheel of the tender, than I had any anxiety for, I replied, "I am satisfied with your word, and have no wish to put you to the trouble of proving it."

The next day I went some distance up the line from Hull, upon the *Star* engine, with Mr. Gray, and returned upon the *Collingwood.* In returning upon the last engine, I observed she was unsteady, and inclined to pitch at low velocities, but lost it all at high. This, I have very little doubt, was owing to the position of the coupling link, as I have found it upon other lines.

This engine had a contrivance for lifting the trailing-wheels off the ground, for the purpose of giving more bite to the driving wheels; and it appears from a statement hereafter given by Mr. Gray, that this is applied to other engines of the Company, though but seldom used.

The average pressure of the steam in the engines worked by Mr. Gray's apparatus, appears to be about 75 lbs.

I was glad to see upon this line the third class passengers accommodated with seats, and to hear that the second class carriages are to have doors with glass panes in them.

The length of this line is 30¾ miles, and of the Leeds and Selby, 24¼. The passengers who go to York, do it in 51 miles, not including about 2 miles of ground which at present they have to travel over twice, for the purpose of going to a station and uniting with another train. To London from Hull, by railway, is 243 miles. Their rate of traveling by the mail on the Hull and Selby, is about 21 miles an hour, including stoppages.

The Company's stock of locomotives, in the middle of December, consisted of 12 engines, and two more nearly off the stocks, coupled in four wheels. Of this stock they have generally from eight to ten in an efficient state. In December they had nine. All their driving wheels have flanches. The average gross load during the first twelve months, including engine and tender, is stated to be 68 tons.

Two crank axles only have broken—one after running ten weeks, and the other at the Hull station. They were uncoupled, and of course both six wheel engines, (the Company have none else,) and the accidents happened in both cases at points from faulty axles, the welding being "about seven-eighths unsound." Not the slightest injury or inconvenience happened to any one. The engine in the second case had no load, and in the first, kept the rails and brought her train home.

There has been no instance of an engine running off the rails, or "anything like it."

The engines are all six wheel, and cost about £1,375; their extreme length is 19 feet 8 inches; height of centre of gravity supposed to be 4 feet, and in the smaller engines 3¾ feet; distance of extreme axles, 10 to 11 feet; height of middle of boiler, 5 feet 7 inches, and 6 feet; diameter of driving-wheels 5¼ and 6 feet, of the other wheels 3¼ feet, of cylinder 12 inches generally, one 14, and 2 coupled 16; stroke, some 18, some 24 inches. The average consumption of coke was 0.53 lbs. per ton per mile on the gross load, which by alterations was reduced to, 0.44, and with Mr. Gray's patent apparatus, to 0.32 lbs.; the corresponding gallons of water evaporated were 27½, 19½, and 15¾. The steam pressure is screwed down to from 60 to 80 lbs. I believe

the latter applies to the engines with Gray's expansive apparatus. The age of their best and worst engines is about 12 and 20 months. The total number of miles run in the first year was 135,000, or an average for each engine of 11,250, and expense per mile run 9d. Each running engine makes two double trips a day, or 124 miles.

With respect to the two kinds of engines, four and six wheel, and their peculiar motions, the following is an abstract of Mr. Gray's replies to the questions in my circular.

He prefers six wheel engines for economy of fuel, steadiness of motion, ease, durability, and less injury to the road. He says they have a little of each kind of motion, peculiar to locomotives, combined in their smaller engines, and less in their larger. With light pulling on straight lines, and especially descending, these motions are most conspicuous. The outside bearings of six wheel engines, he says, "undoubtedly give greater steadiness." He asserts that it is not the imperfections of the road which are the primary cause of the sinuous, pitching, or rolling motions, but that the sinuous "generates the rocking, and, in a slight degree, the pitching as well, however good the road may be;" that their "steadiest engines are their tallest, and this unusual result arises from great length in the front and hind axles." The springs are "rather longer, and a little more elastic (flexible) than usual." "The motions of our larger engines," he observes, "the nearer the centre of the axle the cranks are the better, but there being some other combining causes, it is difficult to say definitely what belongs to each."

The following summary, furnished me by Mr. Gray, will, at the same time that it developes his views on certain points, supply some interesting information not in the previous outline.

"Our engines have each six wheels, but six of them are prepared to lift the hind wheels from the rails, when a deficiency of adhesion is experienced; however, finding their pitching and serpentine motions considerably increased when upon four wheels, we never use them in that state with passenger trains, and but rarely with anything else. All their weight rests upon outside bearings.

"The other six are constantly six wheeled engines, (not being prepared to lift the hind wheels;) all the weight upon the front and hind shafts rests on outside bearings, and have, in consequence, the extensive base for the springs of eleven by six and a half feet, whilst they have inside bearings for the crank axle, and only two inside stay frames, steps, and springs, with all the weight on the crank resting inside of the wheels; thus the advantages of stability in six wheeled engines are secured, and also the chief merit of the London and Birmingham four wheeled engines, in a greater simplicity, and protection to the crank axle, is also obtained.

"The two coupled engines have outside bearings for the front axle, but only inside bearings for the crank and hind axles.

"The weight is 14¼ and 15¼ tons respectively; the weight of the coupled engines is not known yet. The weight of the driving wheels of the former is generally about seven tons.

"The first six engines have about 4¾ tons on the front axle, and the

other six about 6¼ tons, leaving for the former about three tons, and on the latter about two tons upon the hind axle.

J. GRAY."

In a conversation I had with Mr. Gray, he said he thought four wheel engines would be as safe as six, if they were as long between the axles, and had outside bearings.

On this railway I had another opportunity of witnessing a similar accident to that which I witnessed on the Manchester and Leeds Railway. Tuesday morning, on my going to the station, I found the Liverpool engine—the one I had rode on the preceding afternoon —had come in, I think nineteen miles, tail first, with her left eccentric strap broken, by which means she had, of course, only her right cylinder to work with. Here, as in the case on the Manchester and Leeds, the flanches of the left wheels, both hind and fore, and the driving too a little, bore evident symptoms of having been much rubbed against the rails, while the right wheels' flanches had apparently not touched the rails. I pointed out this to Mr. Gray, and mentioned to him the very similar thing I had witnessed on the Manchester and Leeds Railway; but he seemed to think it was more due to the axles being out of square, than to the action of one cylinder; and after my return to town, he wrote to me, saying that he had had the axles measured diagonally, and found "they are a little out of square, inclining the engine to run to the same side where the flanches were observed to be most worn."

I readily present my readers with Mr. Gray's views upon this subject, at the same time begging to observe that I have not yet made up my mind, either from facts or scientific investigation, of what is the true explanation of the phenomena observed.

In the early part of this article I have hinted at some curious facts mentioned to me by Mr. Gray, *relative to longitudinal bearings and cross-sleepers.* The difference of draught in hoar frost and wet weather, Mr. Gray affirmed—and the affirmation was borne out by the testimony of one or two of their men, to whom I spoke on the subject—*was as much as* 50 *or more per cent. against longitudinal bearings*, the draught being so much greater upon them than it was upon cross sleepers. For instance, they assured me that oftentimes when the engine could with difficulty draw its load upon a level, over longitudinal bearings, it would trip up easily enough a rise, which they called their "bank," of 14 or 16 feet a mile, in which the rails were laid upon cross-sleepers.

To me, at first, this was a poser, the solution of which I could not so much as guess at. Being, however, informed that the hoar frost seized the rails on the longitudinal bearings earlier, and left them much later, than it did those on cross-sleepers, I immediately divined the cause, and saw a beautiful, because an altogether unexpected, illustration of the truths of natural philosophy. It is known to philosophers, that before dew can be deposited on any body, this body must become colder than the atmosphere around it, and that hoar frost is nothing but dew, frozen by the temperature of the body on which it is, having sunk below the freezing point, that is, below 32° of Fahr.

It is also known, that the temperature of the earth, a little distance below the surface, is, at night, generally higher than that of the atmosphere. Wood is comparatively a non-conductor of heat. Therefore, and because the rails, where there are cross-sleepers, are imbedded in the ballast to within an inch or two of the top of the rail, and iron is a good conductor of heat, whatever heat the rails lose by radiation, on account of their rough surface, is quickly and wholly, or in a great measure, supplied from the sub-soil, where there are cross-sleepers, while it is not so where the rails are kept from a communication with the subjacent ground, by the broad and deep wood of the longitudinal bearings. The consequence is, that the rails on the longitudinal bearings lose more heat, and faster, and of course become colder earlier, and continue so longer, than those on cross-sleepers. Of course the deposited moisture from the atmosphere is earlier and more copiously condensed, and quicker and harder frozen, upon those than upon these. Hence the whole phenomena of heavier draught, arising from longer and greater slipperiness, upon the longitudinals, and, perhaps, at times of their being slippery when the cross-sleepers are wholly dry, and free from hoar frost.

As a confirmation of this, I may here mention what I observed Tuesday morning, Dec. 21st, upon the Bristol and Exeter Railway. It had been a calm and clear night, for the whole surface of the vegetable country was covered with a thick and hard hoar frost, which can take place in such circumstances only; and the stagnant water was everywhere covered with a thick coat of ice. The rails themselves were so covered with hoar frost, that we were obliged to have the assistance of a pilot engine; and yet with all the united power of two Great Western engines, our speed was comparatively slow. Being upon the platform of the engine, my attention was quickly caught by here and there perceiving patches on the rails, of one to one and a half feet, or perhaps more, perfectly dry and free from hoar frost, amidst the all but universal white which prevailed. Struck with the phenomenon, I looked more closely for something which might develop the cause, and soon saw that these exceptions to the hoar frost invariably appeared over the places where the longitudinal bearings abutted against each other. I called the attention of a relative of mine, who was upon the engine with me, to it, and we observed it for many miles together; so that I am quite satisfied it was owing to no local or accidental circumstance.

The explanation of this—which I call singular and important phenomenon, as bearing upon the relative advantages of two modes of constructing the upper works of railways—is simple and easy. The space between the ends of the longitudinal timbers is too small, and the timbers themselves too large, and maintain too high a temperature, for the hoar frost to affect the ground between them; the consequence is, during the still and clear night, heat is constantly communicated to the rail above by radiation, but chiefly, I apprehend, by the conduction of the atmosphere; by which means it is kept at a temperature that prevents the deposition of dew, and consequently the formation of hoar frost. This effect is of course not confined to a point, but

by the conducting power of the metal, diffused some little distance on each side the joining of the timbers.

Thus, if phenomena and circumstance were carefully attended to, many a lesson might be learned which would lead to improvement, and save hundreds of thousands in the construction of these costly undertakings. But to do it effectually, men must have courage to resist the allurements of comfortable carriages, and travel upon the engine—the only place where observations can efficiently be made—in all seasons and in all weathers. But our philosophising has carried us for the present too far from our friends on the Hull and Selby Railway.

Mr. Gray observed that frosty mornings were not the only times at which they found longitudinal bearings of much heavier draught than cross-sleepers. In wet weather it was the same, and the longitudinals much the heavier to travel over. As it had happened that rain to some extent had fallen, in the night preceding the morning on which we were out, we had an opportunity of witnessing the effect near one of the stations. A train was coming up, and we walked some little distance down to meet it. On its passing, I observed, even under the nail which fastened the rail to the timber, that water was expressed from between the timber and metal, as the engine passed, and re-absorbed the moment after. The same phenomenon, but in an inferior degree, occurred as the carriages passed. Hence, as Mr. Gray observed, "wherever the wheels are, in wet weather, it is a valley, and they are in the position of constantly ascending a hill," which of course much increases the draught.

In very dry weather, Mr. Gray does not think there is much difference between continuous bearings and cross-sleepers. From what I observed on the Midland Counties Railway, I am somewhat sceptical upon this. *I fear the draught is greater, under all circumstances, upon continuous bearings*, and, if I understand them rightly, I think Mr. Kearsley, the superintendent of the locomotives, and Mr. Woodhouse, the engineer of the Midland Counties Railway, are of the same opinion. It is, however, a matter well worth trying, and one which I should like much to put to the test of accurate experiment.

London and Birmingham Railway.

In my "Facts," &c., I omitted to mention that this Company have had nine detentions of trains, from defects of engines. In one case only was the detention nearly three hours; in another 2¾ hours; but the rest varied from about half an hour to about 1½ hour.

Railway Mag.

[To be continued.]

Mr. Vignoles' Lectures on Civil Engineering, at the London University College.

On Artificial Foundations.

Lecture I. Nov. 25th, 1841. After offering some comments on engineering generally, the lecturer alluded in particular to that impor-

tant portion where the skill of the engineer was most required—viz: foundations. After some instructive remarks upon the subject, he said that for the foundation of bridges, a network of timber had been used, and was found to be very good so long as it was under water; but if it were liable to become dry, and exposed to the effects of the atmosphere, it was sure to fail. He recommended concrete as far superior to timber; he had seen concrete forced into a quicksand, and no weight could afterwards force it out. Brick earth and clay form excellent foundations; the whole of St. Paul's, except the north-east corner, was built upon such a foundation, of from four to five feet thick; at the north-east corner, the architect being afraid to trust it to the ground, it being rather softer than the other parts, had the clay removed, and a well, of from twenty to 30 feet square, sunk to a depth of about 40 feet, where the hard bed was found. He then raised a solid mass of masonry to within nine or ten feet of the surface; arches were turned, and the foundation finished at an enormous expense; whereas, a few cubic yards of concrete would have answered equally well, if not better. All must have noticed the hole that was filled up in laying the concrete foundation of the Royal Exchange; there a few cubic yards of concrete did the work more expeditiously, and as well as the ingenuity of the mason could have effected it. He alluded to some of the most remarkable instances of the prodigality of architects in laying foundations, as the Barriére de l' Etoile (a triumphal arch at Paris,) where the cost of the foundation far exceeded the amount of surface work; and the viaduct of the Valley Floré, in which a mass of solid masonry, thirty feet thick, was erected, extending all across the valley. In these cases concrete would have answered the purpose equally well, and at an enormous reduction in expense. He stated that the leading principles he wished to impress upon the minds of the students, were extension of base and equality of surface. He then, at some length, explained the different foundations that had been used for bridge building, and mentioned particularly Ranger's patent for curing defects where foundations have given way, viz:—by using hot water to concrete applied in boxes, the hot water causing the concrete to expand. This was applied to the foundation of the Custom House when it had given way, in consequence of a failure in the piling, which rendered necessary the application of an artificial for a natural foundation. He then remarked upon the various methods now in vogue for keeping the piles of bridges dry while under repair, alluding to caissons, and Mr. Tierney Clark's method of putting in the foundation of the landing place at Gravesend by portable coffer-dams. The Professor concluded his instructive lecture, stating his wish to popularise the knowledge of engineering, as a means of benefiting the public at large.

Lecture II. Wednesday, Dec.1st, 1841.—In the first lecture, Mr. Vignoles gave the general principles of the various descriptions of foundations; in the present, he proceeded to illustrate those principles by diagrams. He stated, that if a good foundation were provided by nature, the subsequent operations were simple, the main point being to imitate nature as closely as possible. Where the soil was bad, con-

siderable skill was required—for instance, in laying the foundation for the pier of a bridge, a wall, or a column, the first point was to give the base extensibility; in proportion as the natural soil was weak, so in equal proportion must the size of the base be increased; the pressure must also be equal—the soundness of the foundation not depending so much upon the amount of settlement as upon its equality. There were various ways of obtaining this, viz:—by the use of concrete alone, or in conjunction with timber, timber alone, or stone, or brick. Having so much insisted upon the necessity of an uniformity, it must be supposed that no portion of the artificial soil should escape; where that was likely, *sheet piling* must be resorted to. He then, by means of diagrams, explained the nature of the method, it being by driving piles close together, all round the foundation—the piles being (say) four inches thick, and as long as might be necessary. This method entirely prevented the escape of the soil in any manner but in a vertical direction, and ensured an uniform sinking, however bad the natural soil might have been. He then alluded to a very large chimney, twenty-two feet square, where the natural soil was a shifting quicksand; concrete was put in in layers, until the bed was eight feet thick; on this was placed a layer of flag-stones, five feet square. Eight days after the work was completed, the whole sunk eighteen inches, without the least deviation from the perpendicular. Other modes had been adopted, amongst which was the following: a number of timber balks were laid across, and concrete placed in the spaces between; then filled up with bricks: timbers were laid in a cross direction, and the flat stones placed upon them. In this instance the wood was laid where no change of atmosphere could affect it. The nature and use of a coffer dam was then explained, and the Professor, at some length, showed the danger of incautiously drawing the piles; the vacuity occasioned by their withdrawal being filled up by the surrounding matter, greatly injured the stability of the foundation. In making one of the London bridges, a great disfigurement had occurred in consequence of the incautious withdrawal of the piles, one side of the pier having sunk one foot. The modern plan to prevent such accidents, was to have a double coffer-dam, the piles of the inner one being cut off, when the outer piles might be withdrawn without danger. In laying foundations, he supposed there was a layer of soft ground, of moderate depth, with a hard substrata; piles must be driven through the soft soil, into the hard bed; a very slight depth would be sufficient, but still, in most cases, sheet piling would be necessary.

The Professor said that he was lately indebted to an officer of the Bengal Engineers, for an account of a very ingenious method, almost universally practised, in laying the foundations of temples and bridges in India. It would not answer here, labour being so dear; but there, where wood was very scarce, building materials in great plenty, and labor very cheap, it was the simplest and most effective that could be imagined. From the explanation, it appeared that the system was the same as piling, but, instead of using wood, small wells of brickwork were substituted. Take, for instance, the pier of a bridge; a

small well of brickwork was constructed—say six feet deep, seven feet in diameter, with a hole through it, three and a half feet in diameter; this is placed on the sandy bed where the foundation is to be made; a workman gets into it, and undermines the well from the inside, the earth being drawn up in buckets; additional layers are added to the top of the well, until a sound bottom was reached; and the singularity was, that there was not one or two of these little wells, but hundreds, and, in certain cases, to a depth of fifty-five feet; arches were then thrown across, and the superstructure raised. When the foundation was in the bed of a river, the excavation went on by the workmen diving through the water to the bottom of the well, and working there until obliged to come to the surface for air; for instance, through ten feet of water in the river, and to the extent of forty feet of water in the well—one of the most extraordinary instances of perseverance upon record. English engineers had somewhat abridged the labor, by substituting an oblong square of fifteen feet by four feet, with two elliptical holes for the workmen; so that, instead of three wells of six feet, they get one of fifteen feet—the principle being precisely the same.

In France, a number of bridges had been built where the water was not rapid, upon a very simple foundation—a framework of timber being made, furnished with short piles at the corner, and laid in the bed of the river, and the superstructure raised upon it, by means of a wooden diving-bell. The *pier perdue* was another way, but could only be used in still water; a quantity of stones were thrown in until a foundation was obtained; where there was any current, this foundation was sure to give way, as in Plymouth Breakwater and Kingston Harbor. He then alluded to the case of one of the London docks, where the wall, being made with too great a curve, from the want of pile sheeting, the soil gave way—the engineer adding fresh matter until the toe of the wall actually appeared (to the astonishment of all) above the surface on the other side. He then gave examples of several original methods of preparing for the formation of foundations in Italy and Ireland, by means of baskets of stones, &c.

Concrete.

The Professor next explained the nature of concrete, and gave directions for its formation, viz:—one part of lime, twice that quantity of sand, and twice as much broken stone, or gravel, as there was sand.

The goodness of the concrete depended upon the quality of the lime. In making concrete, it must be borne in mind that the materials were far more bulky separate than when mixed—for instance, to make a cubic yard of concrete, which contained twenty-seven cubic feet, it would be necessary to have thirty-four cubic feet of materials, besides the water. The three ingredients should be mixed dry, and the water added; in slaking, the concrete will expand about one-thirtieth in bulk.

The great expense of coffer-dams, and of piers generally, had lately led to a very peculiar construction of bridges by piling only, as, for instance, in iron bridges no masonry being used. The Professor

stated that he had built seven or eight bridges upon that system; the piles were driven in, and the iron work erected upon the wood. It had been tried to substitute cast iron for piles, instead of wood, but they had not succeeded, the iron being very liable to break. He also alluded to a beautiful arrangement for fixing branches to piles by means of a sliding collar, but which it is impossible to explain without diagrams. A French work, above two hundred years old was produced, with some very curious engravings of the modes then in use for securing foundations, and which proved that we are using the same means at present, and that many of our so-called new processes were in use at that time. He then concluded by stating, that at his next lecture he should bring forward some more general rules respecting foundations, and after that proceed to consider the best method of securing slopes of earth, now so generally in use.

Lecture III. Wednesday, Dec. 8th, 1841.—Mr. Vignoles explained that at his former lectures he had applied the term "concrete" too generally, and would now explain the difference between "*beton*" and "concrete." Beton was formed of the usual quantity of sand and gravel, broken stones, &c., but, instead of using the ordinary stone lime, hydraulic lime was applied. He then stated that beton is used exclusively under water, concrete only where water does not get in; beton never sets until it is under water, while concrete will not set except it is dry. The lime used for beton must be first slaked, while for concrete it slakes in the process of mixing. Beton sets best when let down gently in cases, and concrete when scattered from an eminence. Beton takes months to become hard, while concrete hardens in a few minutes. That both are in purport essentially the same—to form an artificial stone or rock—the one for works under water, and the other for those on land. He then alluded to the knowledge of the ancients of beton and concrete, and read extracts from the works of sundry authors, from Josephus to the present time, proving that assertion. The use of piles was also very ancient—the foundation of a brick pyramid, in Egypt, having been constructed on that principle. After impressing upon the minds of the students the great importance of a good foundation, and the efficacy of concrete for attaining that end, he concluded by stating that his next lecture would be again on the subject of foundations, and after that he would proceed to lecture upon slopes of earth, and explain the causes of the late accidents upon the different railways, pointing out where the errors of judgment had occurred.

Lecture IV. Wednesday, Dec. 15th, 1841.—Mr. Vignoles commenced by explaining the mode in which piles were driven it, and produced a model of a pile-driving machine (from the museum of the college,) by means of which, he showed the method in which steam power was applied to that machine, for expediting the work—stating, however, that, far from that application being a novelty, he had used it himself twelve or fourteen years ago.

Rock Foundations.

Having treated, in his former lectures, upon foundations in natural

soils, or various kinds of artificial bases, he would now notice such as were of the composite order, being partly on rock, and partly requiring artificial means to render them sufficiently sound for the required purpose. It often happens that, in making a bridge, there may be rock on both sides of the river, and the first pier may rest upon rock, while the second and third may have an insecure foundation, in consequence of a "pot-hole" (as it is called) of sand unexpectedly being discovered in the very spot where these piers are to be erected. The only plan to get over this difficulty is to cut the edge of the hole in steps; sheet-pile it a short space from the wall of the hole, and fill up the intervening space between the piling and the hole with beton, or some other substance, and thus form a continuation of the rock itself. Difficulties also present themselves in solid rock foundations—for instance, in such an erection as that of the Devil's Bridge. The ravine over which the bridge is to be thrown, may have been formed by the running of water; the strata accordingly runs with the usual inclination on both sides. If foundations for the piers of the bridge were not sunk deep enough into the rock, the press of the water filtering through the fissures of the strata, have such force, that, notwithstanding the resistance of the arch, he had known instances of the pier being actually pushed outwards. The only method of avoiding this, was to sink the pier so low into the rocks, and, by means of steps, secure it so firmly, that the force of the water must *break* the pier—not force it outwards—before it could destroy the bridge. The Professor, before going into the question of rock foundations, begged to state, that, in these lectures he only laid down the general principles of foundations; he could not go into the details of the business; and the circumstances of stone foundations were so varied, that it was only by a life of labor and experience that the best method could be arrived at. He wished that each student should, in his private study, well consider, and, by reading, test the correctness of the principles which he laid down for their guidance. A whole year's lecture, repeated every day, would be no more than sufficient to draw the attention of the student to important points—the details could only be gained by practical experience. In preparing the foundation of lighthouses, the whole resources of the engineer must be called into action. A lighthouse must be built in such a manner that it must actually grow from the rock. There are instances where lighthouses have fallen in a body; he could mention one in Ireland, the foundation of which was a solid rock; he saw a party who witnessed its fall, and who informed him that it fell in a solid mass, tearing away a portion of the rock with it. The fault was, that the foundation was not sunk deep enough into the rock. He then alluded to the celebrated Pharos (of Pharos) of Alexander, which was justly reckoned one of the seven wonders of the world; it was built about 283 years B. C., and received its name from the island on which it was built; it was 550 feet high, and the base was 150 feet square, and could be seen at a distance of forty English miles. Josephus, and many other authors, had given descriptions of it, which pretty well agreed; and what was most extraordinary, that the very same method of making the foun-

dation was practised then as now. The stones were dovetailed together, doweled, and run with lead—so as to firmly secure them in their places. The cost of the building amounted to no less a sum than £200,000 of our money, and it lasted above sixteen centuries. No diminution in its height occurred until after 1000 years from its erection, at which time about one-third of its height was wasted away by time; and it was only within about 400 years that the whole is supposed to have been destroyed, and that only by means of an earthquake. He then remarked, that it was very seldom that the name of an engineer was handed down for 2000 years, but all accounts agreed that Sosastros was the name of the engineer who erected this wonder of the world. The celebrated Corduan, or, as it is generally called, Cordovan, Lighthouse, at the mouth of the Garron, is built upon the same principles as the Pharos; this lighthouse is, however, circular, but the masonry is not calculated for durability—it being built of freestone. The expense of this lighthouse was enormous, as must be supposed when millions of francs were expended upon ornament, which was the more absurd when it was considered that it stood upon a barren rock, in the middle of the sea. He could not help quoting a line of Pope—

"'Tis only usefulness that sanctifies expense."

This is a sentiment that he wished to impress upon the minds of all his students, for it was a great fault of modern engineers to expend great sums upon ornament, which could be far better employed upon actual necessaries. He then turned to the Eddystone Lighthouse, and related the histories and fates of the two lighthouses preceding the one now standing, which was erected by the genius of Smeaton, and strongly recommended his pupils to read the account published of that great work. The Eddystone rock is peculiarly interesting to the engineer; it is found first at about one mile deep in the ocean, and then rises gradually about one foot in ten, until it reaches near the level of the sea, when a sudden crop makes its appearance, and rises above the surface. From the peculiar formation of this rock, there is always a heavy run upon it, which renders it so very dangerous. The learned Professor, after explaining at some length the process of the erection of this celebrated lighthouse, concluded his lecture. Mining Jour.

(To be continued.)

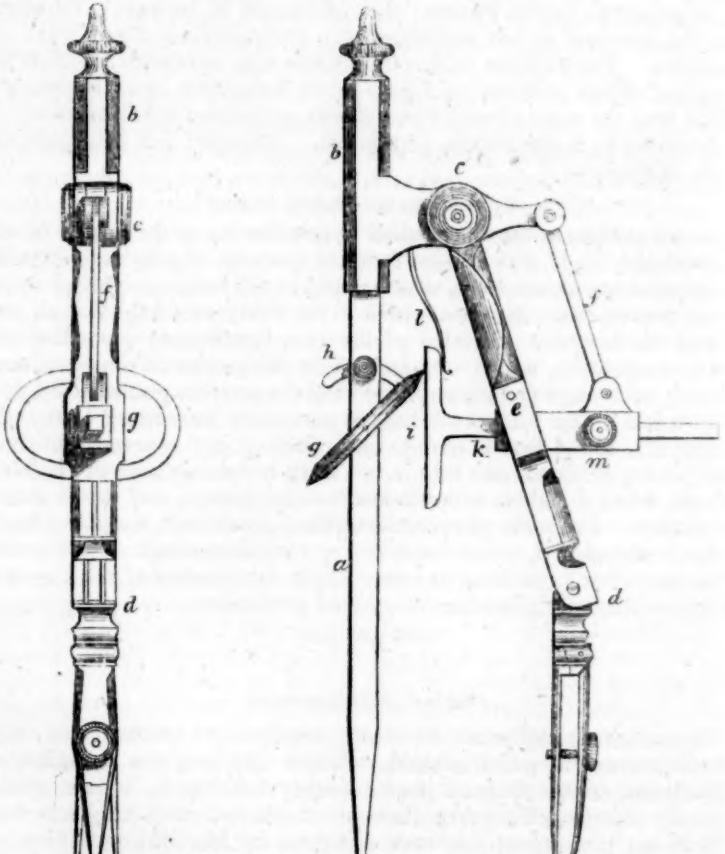
Davies' Elliptograph.

Mechanical draughtsmen have long required the assistance of some simple instrument which should, without any previous complicated adjustment, enable them at once to strike the ellipses, which would correctly represent the perspective of wheels and other circles.

Such an instrument has been designed by Mr. Henry Davies, already well known as the author of several other useful and highly important inventions, and we have much pleasure in adding to the list, that which is represented in the following engraving.

This ingenious little instrument consists of an upright stem, or axis,

which terminates at its lower end in two points, *a*, *a*, to give it the required stability in a perfectly vertical position. On the upper part of this axis a compass head, *b*, revolves, having attached to it, by a joint at *c*, the pen, or compass limb, *c*, *d*. A square, horizontal shaft is jointed into the latter at *e*, and maintained in its position by the parallel rod, *f*. Upon the central shaft, or axis, *a*, there is pivoted a circular steel plate with beveled edges, *g*, which may be set at any required angle to the horizon by the quadrant and set screw, *h*. A T-shaped guide, *i*, has its longer stem, *k*, passed through the horizontal shaft, and held by the set screw, *m*. The face of the guide, *i*, is constantly kept in close contact with the edge of the circular disk, *g*, by means of a small spring, *l*.



A glance at this arrangement will almost suffice to show its operation. Suppose, in the first place, that the disk *i* is set perfectly hori-

zontal, and the instrument applied to describe a figure upon paper; on turning round the compass limb and pen, *c*, *d*, a transcript of the disk, *g*, that is a circle, will be delineated, because the pen has been guided round in a circular path, by the spring *l*. Let the disk *g* be now set at any angle, say 45°, and the instrument applied to paper and turned round; the pen will again be guided round the disk *g*, but no longer in a circular path; an ellipse will be described, which will be the correct perspective of a wheel or circle, viewed at an angle of 45°; and so of circles viewed at any other angles, of a size within the powers of the instrument.

The set screw, *m*, allows the compass to be set to the size of the circle required; at the same time the guide, *i*, is always maintained in contact with the disk.

We hope and trust that this convenient and ingenious little instrument will be speedily brought before the public, in a form, and at a price, that will enable all parties to avail themselves of its important advantages.

Mech. Mag.

Description of the Bann Reservoirs, County Down, Ireland.

By John Frederick Bateman, *M. Inst. C. E.*

The situation fixed upon for the reservoir, rendered necessary the construction of four embankments between the hills, so as to raise the water to a height of 35 feet above the summer level of the lake.

These embankments were all constructed in a similar manner, only varying in the slopes and thickness of the stone facing, according to the extent and situation.

The whole substratum of the valley was water-tight, either from the existence of the solid rock, dense clay, or of hard, compact, mountain gravel; so that there was no difficulty in securing the foot of the puddle. A trench was sunk into the water-tight stratum, whence the vertical puddle wall was carried up with the bank to the required height. It was twelve feet in width at forty feet below the top, diminishing gradually to eight feet wide at the summit, and was worked in regular layers of eight inches in thickness.

The embankments were formed in concave layers, three feet thick —each layer being completed before another was commenced—steps being cut in the ground where necessary, to receive the layers.

In order further to secure the tightness of the bank, a lining of peat, fifteen inches in thickness, was brought up on the inside of the puddle, and a layer of the same material was laid upon the face of the slope; it was cut small, placed in thin courses like the puddle, and merely trodden down without more moisture than it naturally contained. The author advocates the use of peat in such positions, as from its light and fibrous nature, in case of a leak occurring, the draught would attract into it all the fibrous particles, which by degrees would stop the holes sufficiently for the silt to settle over, and effectually close, the aperture.

Above the peat, a course of gravel, three feet in thickness, was laid, and upon that the stone pitching, forming the inner side of the bank.

The inner slopes were, for twenty feet below the top of the bank, two and a half horizontal to one vertical; the outer were two horizontal to one vertical; where they were deeper than twenty feet, the remainder of the banks sloped three to one on the inside, and two and a half to one on the outside.

All the embankments are twelve feet wide at the top, and five feet above the water level.

The centre of the deepest part of the embankment was traversed by a stone culvert, in which were placed two rows of cast-iron discharge pipes, eighteen inches diameter, with suitable valves. A leak was discovered in the centre of the masonry of this culvert, occasioned by the engineer's instructions not being obeyed. The details of the methods employed for remedying this defect, are given at length, as also those of the experiments upon cements made by the author after the data given by Vicat. The materials which were most accessible for the work, were tested very carefully, and from the results, it was determined to employ mortar composed of rich Manx, or mountain lime, carefully slaked, and clay burned with peat in the open air. The proportions were two and a half of clay to one of lime. They were ground together, and being mixed with as much water as was necessary, the mortar was used immediately. The mortar for the backing had one measure of sand added; the grout had two measures of sand in it, and was used thin.

The concrete was composed of one part of lime, two and a half of calcined clay, and about three parts of sharp gravel.

This cement appeared to set hard, and to be perfectly tight; but when the reservoir was partially filled, several leaks were discovered, which rendered an examination necessary, and some energetic measures were taken to stop them, all which are described.

The result of the author's experience seems to be, that mortar made from rich lime and calcined clay, as recommended by Vicat, may set and harden under water, when there is little pressure, but that it is not able to resist the pressure of a considerable depth of water. *

The details of the construction of the masonry of the valve house, the fore bay, the waste weir, the bridge of three arches, constructed over the feeder from the river Muddock, and the various feeders for supplying the reservoir, are given at length, with the particulars of the expenditure of the sum of £14,891, which was the cost of the work, exclusive of land compensation, or salaries and professional charges.—*Proceed. of Instit. of Civ. Eng.* Civ. Eng. & Arch. Jour.

* Colonel (now Major General) Pasley, of the Royal British Engineers, in his admirable work on Cements, &c., having clearly proved that *a factitious water cement can* be made from *chalk-lime, and blue clay,* which will equal *the best natural cements* of England, we must ascribe this partial failure to some defect in the process of M. Vicat—which, it must be remembered, has received the censure both of General Treussart and Colonel Pasley, the best writers upon the subject of *water cements.* M.

Physical Science.

On the Chemical Statics of Organized Beings. Extract from the concluding Lecture, in L'Ecole de Médecine in Paris. By M. DUMAS.

[CONTINUED FROM PAGE 28.]

II. Since [the causes of] all the phenomena of life are exerted upon matters which have for their base carbon, hydrogen, azote, oxygen; since these matters pass over from the animal kingdom to the vegetable kingdom, by intermediary forms, carbonic acid, water, and the oxide of ammonium; lastly, since air is the source whence the vegetable kingdom is fed, and the reservoir in which the animal kingdom is annihilated—we are led to take a rapid survey of these different bodies with a special view to general physiology.

Composition of Water.

Water is incessantly formed and decomposed in animals and plants; to appreciate what results from this, let us first see how it is composed. Some experiments founded on the direct combustion of hydrogen, and in which I have produced more than two pounds of artificial water—experiments which are in truth very difficult and very delicate, but in which any errors would be unimportant with regard to the circumstances which we are engaged upon—make it very probable that water is formed, in weight, of 1 part hydrogen, and 8 parts oxygen, and that these whole and simple numbers express the true relation according to which these two elements combine to form water.

As substances always present themselves to the eyes of the chemist by molecules, as he always endeavors to connect in his thoughts, with the name of each substance, the weight of the molecule, the simplicity of this relation is not unimportant.

In fact, each molecule of water being formed of one molecule of hydrogen, and one molecule of oxygen, we arrive at these simple numbers, which cannot be forgotten.

A molecule of hydrogen weighs 1; a molecule of oxygen weighs 8; and a molecule of water weighs 9.

Composition of Carbonic Acid.

Carbonic acid keeps incessantly forming in animals, and is continually undergoing decomposition in plants; its composition, therefore, deserves a special notice in its turn.

Now, carbonic acid, like water, is represented by the most simple numbers. Experiments founded on the direct combustion of the diamond, and on its conversion into carbonic acid, have proved to me that this acid is formed of the combination of 6 parts by weight of carbon, and 16 parts by weight of oxygen.

We are, therefore, led to represent carbonic acid as being formed of one molecule of carbon weighing 6, and two molecules of oxygen

weighing 16, which constitute one molecule of carbonic acid weighing 22.

Composition of Ammonia.

Lastly, ammonia, in its turn, seems formed in whole numbers of 3 parts of hydrogen and 14 of azote, which may be represented by 3 molecules of hydrogen weighing 3, and by one molecule of azote weighing 14.

Thus, as if the better to show all her power, Nature operates, in the business of organization, upon a very small number only of elements, combined in the most simple proportions.

The atomic system of the physiologist revolves on these four numbers—1, 6, 7, 8. 1 is the molecule of hydrogen; 6 that of carbon; 7, or twice 7, i. e. 14, that of azote; 8 that of oxygen.

These numbers should always be associated with these names, because for the chemist there can exist no abstract hydrogen, nor carbon, nor azote, nor oxygen. They are beings in their reality which he has always in view; it is of their molecules that he always speaks; and to him the word hydrogen depicts a molecule which weighs 1; the word carbon, a molecule which weighs 6; and the word oxygen, a molecule which weighs 8.

Composition of the Air.

Does atmospheric air, which performs so great a part in organic nature, also possess as simple a composition as water, carbonic acid, and ammonia? This is the question which M. Boussingault and I have recently been studying. Now we have found that, as the greater number of chemists have thought, and contrary to the opinion of Dr. Prout, to whom chemistry owes so many ingenious views, air is a mixture, a true mixture.

In weight, air contains 2,300 of oxygen for 7,700 of azote; in volume, 208 of the first for 792 of the second. The air, besides, contains from 4 to 6 10,000ths of carbonic acid in volume, whether it be taken at Paris or in the country. Ordinarily, it contains 4 10,000ths. Moreover, it contains a nearly equal quantity of the carburetted hydrogen gas, which is called marsh gas, and which stagnant waters disengage perpetually.

We do not speak of aqueous vapor, which is so variable; of oxide of ammonium and of nitric acid, which can only have a momentary existence in the air, because of their solubility in water.

The air, then, is constituted of a mixture of oxygen, azote, carbonic acid, and marsh gas.

The carbonic acid in it varies, and indeed greatly, since the differences in it extend almost from the simple to the double, from 4 to 6 10,000ths. May this not be a proof that plants take from the air this carbonic acid, and that animals take back a part from it? In a word, may not this be a proof of that equilibrium of the elements of the air attributed to the inverse actions which animals and plants produce upon it?

It has, indeed, been long since remarked, that animals borrow from the air its oxygen, and give to it carbonic acid; plants, in their turn,

decompose this carbonic acid, it order to fix its carbon, and restore its oxygen to the air.

As animals breathe continually; as plants breathe under the solar influence only; as in winter the earth is stript, whilst in summer it is covered with verdure—it has been supposed that the air must transfer all these influences into its constitution.

Carbonic acid should augment by night, and diminish by day. Oxygen, in its turn, should follow an inverse progress.

Carbonic acid should also follow the course of the seasons, and oxygen obey the same law.

All this is true, without doubt, and quite perceptible as to a portion of air limited and confined under a jar; but, in the mass of the atmosphere, all these local variations blend and disappear. Accumulated centuries are requisite in order effectually to put in action this balance of the two kingdoms, with regard to the composition of air; we are then, very far from those daily or yearly variations, which we had been apt to look upon as being as easy to observe as to foresee. With regard to oxygen, calculation shows that, exaggerating all the data, not less than 800,000 years would be required for the animals living on the surface of the earth to consume it entirely.

Consequently, if we suppose that an analysis of the air had been made in 1800, and that during the entire century plants had ceased to perform their functions on the surface of the whole globe, the animals at the same time all continuing to live, the analysts in 1900 would find the oxygen of the air diminished by 1-8000th of its weight—a quantity which is beyond the reach of our most delicate methods of observation, and which, assuredly, would have no influence whatever on the life of animals or plants.

As to this, then, we cannot be deceived; the oxygen of the air is consumed by animals, who convert it into water and carbonic acid; it is restored by plants, which decompose these two bodies.

But nature has arranged everything so that the store of air should be such, with relation to the consumption of animals, that the want of the intervention of plants for the purification of the air, should not be felt until centuries have elapsed.

The air which surrounds us weighs as much as 581,000 cubic kilometres of copper; its oxygen weighs as much as 134,000 of these same cubes. Supposing the earth peopled with a thousand millions of men, and estimating the animal population at a quantity equivalent to three thousand millions of men, we should find that these quantities united consume in a century only a weight of oxygen equal to 15 or 16 cubic kilometres of copper, whilst the air contains 134,000 of it. It would require 10,000 years for all these men to produce a perceptible effect upon the eudiometer of Volta, even supposing vegetable life annihilated during all this time.

In regard to the permanence of the composition of air, we may say with all confidence, that the proportion of oxygen which it contains is secured for many centuries, even reckoning for nothing the influence of vegetables, and that nevertheless, these restore oxygen to it incessantly, in quantity at least equal to that it loses, and perhaps

more—for vegetables live just as much at the expense of the carbonic acid furnished by volcanoes, as at the expense of the carbonic acid furnished by animals themselves. It is not then for the purpose of purifying the air that these breathe, that vegetables are especially necessary to animals; it is, above all, to furnish them incessantly with organic matter quite ready for assimilation—organic matter which they may turn to their advantage.

There is, therefore, a service necessary, without doubt—but so remote, that it can scarcely be recognised—which vegetables render us, in purifying the air which we consume. There is another service, so immediate, that if, during a single year, it were to fail us, the earth would be depopulated; it is that which these same vegetables render us by preparing our nutriment, and that of all the animal kingdom. In this, especially, is found, the chain that binds together the two kingdoms. Annihilate plants, and the animals all perish of a dreadful famine; organic nature itself entirely disappears with them in a few seasons.

We have, however, said that the carbonic acid of the air varies from 4 to 6 10,000ths. These variations are very frequent, and very easy to observe. Is not this a phenomenon reproaching the influence of animals who introduce this acid into the air, and that of vegetables which deprive it of it?

No; this phenomenon, you are aware, is a simple meteorological phenomenon. It is with carbonic acid as with aqueous vapor, which forms on the surface of the sea, to become condensed elsewhere, fall again in rain, and be reproduced under the form of vapor. This water, which is condensed and falls, dissolves, and carries with it carbonic acid; this water, which evaporates, yields up the same gas to the air.

A great meteorological interest would attach to the observation of the variations of the hygrometer, and those of the seasons, or of the state of the sky with the variations of the carbonic acid of the air: but hitherto all tends to show that these rapid variations constitute a simple meteorological event, and not, as had been thought, a physiological event, which, singly considered, would infallibly produce variations infinitely slower than those which are, in fact, observed as much in towns as in the country itself.

Thus the air is an immense reservoir, whence plants may for a long time derive all the carbonic acid necessary for their wants; where animals, during a much longer time still, will find all the oxygen that they can consume. It is also from the atmosphere that plants derive their azote, whether directly or indirectly: it is there that animals finally restore it.

The atmosphere is, therefore, a mixture which unceasingly receives and supplies oxygen, azote or carbonic acid, by means of a thousand exchanges, of which it is now easy to form a just idea, and the details of which a rapid analysis will now enable us to appreciate.

Gardener's Mag.

[TO BE CONTINUED.]

Hourly Meteorological Observations during the Equinoxial periods from December, 1840, to March, 1842; made at the University of Nashville, Tennessee, in North Latitude 36° 09′ 33″, W. Long. 86° 49′ 03″, by JAMES HAMILTON, *Prof. Math. and Nat. Phil.*

The position of the instruments is the same as reported heretofore. The only change of instruments is the substitution of Jones' Improved Englefield Barometer, in place of the old English Barometer. As I have not reduced the observations, it is proper to add that the cup is one inch in diameter, and one inch in depth. The tube is about one-tenth of an inch in diameter, and is marked 53.

December 21, 1840.

Hour.	Ex. Ther.	At. Ther.	Bar.	Weather.	Wind. dir.	Wind. force.	Remarks.
	deg.	deg.	in.				
6 A. M.	21	33.5	29.780	Clear.	W. / N.E.	0	
7	21	33.5	29.782	do.	do.	0	Light clouds in horizon and
8	22.5	33.5	29.784	do.	do.	0	some fog.
9	29	35	29.782	½ Clear.	do.	0	Fog denser. Cinostratus.
10	34	35	29.788	do.	S. of W. / N.E.	1	Cinostratus.
11	37	36	29.754	¾ Clear.	S.W. / N.E.	1	Cinus.
12	39	36.5	29.724	do.	do.	1	Cinostratus. Dew pt. 20.25°.
1 P. M.	41.5	37.5	29.696	do.	do.	1	do.
2	43.5	37	29.678	Clear.	do.	1	
3	43.5	37	29.662	do.	do.	2	No clouds, but hazy near horizon Dew pt. 24°.
4	41	37	29.646	do.	S.W. / E.	2	No clouds.
5	38	37	29.637	do.	S.E.	2	Stratum of clouds in West, and hazy in the East.
6	35.5	37	29.632	do.	do.	1	
7	34.5	37	29.624	do.	do.	1	West, stratum rising.
8	37	38	29.624	Cloudy.	do.	1	Sky covered with clouds.
9	38	38	29.638	do.	do.	1	Do. Dew pt. 28.
10	39	38	29.639	do.	do.	0	Do.
11	39	39	29.640	do.	do.	0	Do.
12	39	39	29.640	do.	do.	0	Do.

Minimum of Thermometer during night, . 39°

Morning of Dec. 22nd Wind N. E., but clear.

March 22, 1841.

Minimum during the night, ... 56.5°.

6 A. M.	61.5	62	29.182	½ Clear.	S.W.	2	Cirrus above and Cumulus below. Sun rises above thick cl'ds; shines dimly at 6h 50m.
7	61.5	62	29.182	do.	do.	2	
8	65	62.5	29.170	½ Clear.	do.	3	Clouds thicken at 9h. 50m.
9	69	63	29.169	do.	do.	3	Wind 5.
10	71	64	29.126	do.	do.	4	
11	73	64.5	29.100	¾ Clear.	do.	4	Sun shines.
11½	Clouds more dense.						
12	76	65	29.050	do.	do.	3	
1 P. M.	77	66	28.990	Clear.	do.	3	
2	77	67	28.940	½ Clear.	do.	4	Clouding again.

Hour.	Ex. Ther. deg.	At. Ther. deg.	Bar. in.	Weather.	Wind. dir.	force.	Remarks.
3 P. M.	77	67	28.918	Clear.	S.W.	4	Dew point 56°.
4	75	67	28.900	Cloudy.	do.	5	
5	71	67	28.886	do.	do.	5	
6	69	67	28.880	*r.*	do.	4	Rain moderate.
7	66	67	28.871	do.	do.	1	Do.
8	62	66	28.866	R.	S.W.	2	Rain became heavy at 7h. 55m.
9	66	60	28.858	*r.*	do.	1	
10	60	66	28.850	*r.*	do.	2	
11	59	66	28.850	R.	S.W.by W.	7	Storm violent.
12	52	64	28.900	*c.*	W.	4	Begins to clear.

Minimum of Thermometer during night, . . 37°.

March 23—Barometer 29.210 N.W. Clear.

June 21, 1841.

Not observed more than other days.

9 A. M.	84	83	28.758	Clear.	S.W.	2	
Noon.	89	83	28.754	½ Clear.	do.	2	
3 P. M.	92	84	28.700	*c.*	do.	3	Dew point 66°.

Minimum of Thermometer, 69°. Thunder storms on 20th and 22nd.

September 21, 1841.

Minimum 65°.

6 A. M.	68	73	28.925	Cloudy.	S.W.	3	
7	69	73	28.922	do.	do.	3	A little rain fm. 7h. 50m to 8h. 05.
8	70.5	73.5	28.918	*r.*	do.	3	
9	75	74	28.904	*c.*	do.	4	
10	77	74.5	28.892	*c.*	do.	3	
11	75	74	28.892	*r.*	do.	3	
12	76.5	74.5	28.882	*r.*	do.	5	
1 P. M.	77	74.5	28.810	*c.*	do.	5	
2	76	74.5	28.808	*r.*	do.	2	Rain heavy from 2h. to 2½h.
3	76	75	28.810	*c.*	do.	2	Dew point 64°.
4	77	75	28.810	*c.*	do.	2	
5	74	75	28.818	*c.*	do.	1	
6	71	74.5	28.818	*c.*	do.	1	Signs of clearing.
7	69	74.5	28.812	*c.*	S.W.by W.	0	Lightens in S.
8	68	74	28.812	*c.*	do.	0	Do. Clouds in W.
9	68	74	28.816	*c.*	do.	0	Lightens in W. Clouds increase.
10	65	74	28.820	*r.*	W.	3	Th. Storm at 9h. 40m.
11	63	73	28.826	*c.*	W.	1	Clearing.
12	62	73	20.826	*c.*	W.	1	Do.

Minimum during night . . 58°.

September 22—Cloudy, but wind from West. Barometer at 9 A. M. 28.836.
Amount of rain 24-100 inch.

December 21, 1841.

Minimum of Thermometer, . . 41°.

6 A. M.	41	47	29.442	*c.*	S.W. / N.E.	2	Amount of rain on 20th, .70 inch.
7	41	47	29.450	do.	do.	1	
8	41	47.5	29.500	do.	do.	2	Clouds break in N.
9	41.5	47.5	29.534	do.	do.	3	
10	43	47.5	29,544	do.	do.	3	Clouds light in N.; heavy in S.
11	45	47.5	29.544	do.	do.	3	Do.
12	46	47.5	29.506	do.	do.	3	Do. Dew point 21°.
1 P. M.	47	47.5	29.500	do.	do.	3	
2	47.5	47.5	29.496	do.	S.W. / E.	3	Almost clear in N.
3	46	47.5	29.490	do.	E.	3	

Hour.	Ex. Ther. deg.	At. Ther. deg.	Bar. in.	Weather.	Wind. dir.	Wind. force.	Remarks.
4 P. M.	45	47.5	29.502	c.	E.	2	
5	45	47.5	29.500	do.	do.	2	
6	45	47.5	29.498	do.	do.	2	
7th, 8th, and 9th hours, no change.							
10	45	47	29.498	do.	do.	0	
11	45	46	29.486	do.	do.	0	
12	45	46	29.484	do.	do.	0	

December 22—Min. 44°. Bar. 29.418 at 9 A. M.

Amount of rain on 21st = .08; on 22nd = .72.

March 21, 1842.

Minimum of Thermometer, . . 65°.

6 A. M.	67	71	29.050	c.	W.	3	
7	68.5	71	29.072	c.	do.	3	
8	69.5	71	29.080	c.	do.	3	
9	68.5	71	29.100	c.	do.	3	
10	72	71.5	29.084	c.	do.	3	
11	73	71.5	29.086	c.	do.	3	
12	76	72	29.052	Clear.	do.	3	Clouds only in S. Dew pt. 55°.
1 P. M.	77	72	29.020	do.	do.	2	Wind rises at 1½ P. M.
2	78	72.5	28.996	do.	do.	5	
3	79	72.5	28.984	do.	do.	5	
4	79	72.5	28.980	do.	do.	5	
5	78	73	28.976	do.	do.	5	
6	74	73	28.986	do.	do.	4	
7	73	73	28.990	do.	do.	2	Cumuli in N.
8	71	73	28.992	do.	do.	1	
9	70	73	29.020	do.	do.	1	
10	69	72.5	29.038	½ Clear.	do.	2	A few thin clouds.
11	67.5	72.5	29.054	Clear.	do.	2	
12	66	72	29.060	do.	N.	0	

March 22—Min. of Ther. 48°. Bar. 29.196 at 9 A. M. Wind N. E., but clear.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

A Comparison of the Mean Temperature of the Year with the Mean Temperature of October and April. By C. B. Hayden.

Pouillet, in the meteorological portion of his Eléméns de Physique, &c., announces as a general law the close approximation of the mean temperature of October to that of the year, and asserts that the former may be regarded as a substitute for the latter, and quotes, in illustration, a table from one of Humboldt's Meteorological Memoirs, which sufficiently confirms the law for the contained localities. To ascertain how far this law was applicable to the United States, the accompanying table was compiled from data furnished by the North American Almanac, Army Register, and such other sources as were most readily accessible. This table includes localities from a wide area of country, presenting a great variety of climate, not only as dependent upon latitude, but upon literal and inland situation. The * in the table indicate that for the localities to which they are annexed, the mean temperature of April is nearer that of the year than the mean temperature of October; and as this number amounts to forty-one, out of seventy, localities, or about fifty-nine per cent., it shows an important variation of the above-mentioned law, in refer-

ence to the United States. The closer approximation of the mean temperature of April to that of the year, seems to be general, not only for the more uniform climate of the coast and great lakes, but the more excessive climate of the interior, as well as for the northern and southern portions of the Union—though the exceptions in favor of October are most numerous in the middle and southern States. As a general rule, the mean of October is *higher* than that of April, and both are *lower* than the mean of the year in the United States.

Localities.	Mean of Year.	Mean of October.	Mean of April.	Series of Obs. years.	Observers.
Baltimore *	52.94	54.87	52.12	8	L. Brantz.
Salem *	48.86	51.34	46.62	43	D. Holyoke.
Medfield *	46.48	50.11	43.18	12	D. C. Sanders.
Eastport *	41.75	46.08	39.50	2	
Burlington	43.60	47.70	39.40	1	
Albany *	44.73	42.32	42.71	1	
Auburn, N. Y. *	44.75	40.71	41.77	1	
Canandaigua, N. Y.	43.78	42.42	51.44	1	
Cherry Valley,* "	41.25	37.91	40,72	1	
Clinton "	46.92	48.89	42.83	1	
Cortland * "	42.04	38.43	40.45	1	
Dutchess * "	47.32	45.24	46.60	1	
Erasmus "	47.73	47.28	46.21	1	
Fairfield * "	42.48	37.53	41.89	1	
Fredonia * "	44.54	41.54	44.76	1	
Granville "	45.88	48.09	42.04	1	
Hamilton * "	40.45	35.98	39.98	1	
Hartwick * "	44.92	39.66	45.38	1	
Ithaca * "	44.28	40.21	42.75	1	
Johnstown "	42.31	40.76	38.62	1	
Kinderhook * "	43.81	40.39	42.37	1	
Kingston * "	45.94	43.58	44.17	1	
Lansinburgh "	47.82	46.73	41.40	1	
Lewiston "	43.54	40.27	40.20	1	
Monroe * "	44.69	40.84	43.18	1	
Montgomery * "	44.25	39.30	41.74	1	
Newburgh * "	45.73	44 35	45.26	1	
Oneida * "	44.31	40.16	40.41	1	
Onondaga * "	45.16	41.60	42.81	1	
Oxford * "	42.80	39.85	41.44	1	
Pompey * "	40.18	36.11	39.21	1	
Redhook * "	46.11	44.65	46.28	1	
Rochester * "	44.01	41.36	42.92	1	
St. Lawrence * "	40.78	36.88	40.01	1	
Schenectady "	44.66	43.27	42.66	1	
Union "	43.11	40.51	38.70	1	
Union Hall "	46.52	45.47	45.07	1	
Utica "	40.89	39.34	37.81	1	

Localities.	Mean of Year.	Mean of October.	Mean of April.	Series of Obs. years.	Observers.
New Orleans	66.00	65.11	69.25	1	Dr. Barton.
St. Louis	54.35	52.10	58.55	8	
Fort Howard *	45.282	50.02	43.25	5	Army Register.
Fort Wolcott	50.28	54.20	45.71	5	"
Fort Columbus	53.13	55.85	49.15	5	"
Fort Snelling *	45.77	49.50	42.49	3	"
Fort Preble *	46.92	49.20	45.01	3	"
Fort Niagara *	51.69	58.94	47.52	2	"
Fort Brady	41.84	46.43	37.20	3	"
Fort Armstrong *	51.57	55.36	51.29	3	"
Fort Monroe *	61.57	57.58	64.33	3	"
Fort Vancouver	51.75	54.00	46.00	3	"
Fort Gibson *	62.90	65.95	61.28	3	"
Fort Hancock *	41.21	45.66	43.84	2	"
Council Bluffs *	51.80	57.41	47.95	3	"
West Point	52.74	52.66	50.54	3	"
Washington	55.68	56.41	53.71	3	"
Jefferson Barracks *	57.77	59.18	56.12	3	"
Augusta Arsenal	65.24	46.76	64.29	3	"
Petite Coquille	71.40	73.10	69.28	3	"
St. Augustine	72.24	73.61	68.68	3	"
Dover, N. H.	44.50	46.60	48.70	7	A. A. Tuffts.
Summerville, Ga.	66.52	68.00	63.96	1	Dr. Holbrook.
Natchez	67.50	71.60	74.90	1	Dr. H. Tooley.
Bloomington, Iowa,	54.20	60.70	62.70	1	T. S. Parvin.
Marietta *	51.80	50.94	52.49	10	S. P. Hildreth.
Key West	76.50	77.45	74.50	7	S. Whitehead.
Nashville *	59.00	62.30	61.94	2	Prof. Hamilton.
Providence *	46.90	51.32	44.58	2	Prof. Caswell.
Dartmouth *	40.10	43.08	37.63	3	
Concord	43.37	42.33	45.60	10	M. J. Farmer.
Savannah *	66.11	68.60	67.31	2	

Abington, Va., May 24th, 1842.

On Fossil Bones found on the Surface of a Raised Beach, at the Hoe, near Plymouth. By Dr. Moore.

In our reports of the Meeting of the British Association at Plymouth, (*Athen.* No. 721,) an abstract will be found of a paper, by Dr. Moore, on those fossil bones, and a notice of the objections which were made to the author's inferences. In the memoir read to the Geological Society on the 5th of January, the substance of the former communication is given, but its principal object is to prove,—1st, That the bones could not have been derived from the emptying of a cave, bearing all the evidence of having been deposited where they were found at a very remote period, and probably long before they could

have been affected by human agency; 2ndly, That the beach with associated bones could not be a diluvial, or drift, accumulation, because it resembles in character a modern beach, and contains marine shells, and because the bones were found not in, but upon, the deposit; 3rdly, That the beach did not result from glacial action, as there are no indications of it in the neighbouring districts; lastly, he maintains his former views respecting the beach having been raised above the level of the sea, and at a period about, or probably more recent than, the time when the animals, whose remains are found upon it, disappeared. Appended to the paper was a note on a mass of limestone perforated by irregular cavities, considered, by Dr. Buckland, to be due to the action of snails, but which Dr. Moore conceives were formed by pholades.—*Transactions Geological Society.* Athenæum.

An account of the Contortions and Faults produced in the Strata underneath and adjacent to the Great Embankment across the Valley of the Brent, on the Line of the Great Western Railway. *By* Mr. Colthurst.

The vegetable soil, on which the embankment was thrown up, rests on a stratum four feet thick, of brown or alluvial clay, under which is a bed of gravel, varying in thickness from ten to three feet, and the whole reposes on London clay of the usual characters. The surface of the valley at this part gradually slopes towards the Brent, the difference of level between the southern or more distant side of the earthwork and the river, being about twenty feet. The height of the embankment is fifty-four feet. On the night of the 21st of May, a settlement was first noticed, and in the morning the foundation was discovered to have given way, and a large mass of ground fifty feet long and fifteen feet wide, to have protruded on the south side, towards the Brent. During the four succeeding months this mass continued to increase, and the disturbance to extend, so that, at the end of that period, the surface, to a considerable distance from the base of the embankment, had assumed an undulated outline, and the subjacent strata, where they were cut into, exhibited corresponding curvatures, cracks, and overlappings in the beds, due to horizontal movements. In the earthwork itself, up to this time, the only evidence of failure, in addition to a sinking in the surface of fifteen feet, was a large crack near the top, and on the side opposite to that in which the foundation had yielded, but slanting towards the same point. Passing over the effects gradually produced during a period of nearly twelve months, at the end of which the total subsidence had exceeded thirty feet, and the swollen ground at the base of the embankment had attained an average height of ten feet, with a range parallel to the earthwork of nearly four hundred feet, and an occasional horizontal displacement of fifteen feet, the author proceeds to describe the nature of the curvatures and other irregularities produced in the strata extending two hundred and twenty feet, or from the foot of the earthwork to the Brent, the bank of which was forced five feet in-

wards; but it is impossible to render the account intelligible without the aid of diagrams. The remedy applied by Mr. Brunel was a supplementary embankment, or terrace, thrown down on the protruded mass; and it has proved effectual. In the second part of the paper, the author dwells upon the magnitude of the disturbing effects thus produced by human agency, and asserts his belief that many of the distortions visible in the solid strata of the earth may have been produced by the effects of superincumbent masses thrown down upon them by the ordinary operations of nature; but while he advocates the explanation of certain geological phenomena by means of pressure from without, he does not deny that many, and more especially the most considerable irregularities which occur in the structure of the earth, may be assigned to other causes. Ibid.

Franklin Institute.

COMMITTEE ON SCIENCE AND THE ARTS.

Spaulding & Isherwood's Cast Iron Rails for Railroads. *

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the model and drawings of Cast Iron Rails for Railroads, invented by Messrs. Spaulding & Isherwood, of Owego, New York, REPORT:

That they have attentively examined the model and drawings of this rail, which have been submitted to the Institute, and have discussed the merits of the invention.

They find that this *cast iron rail* consists of two curved ribs in a vertical plane, about eight inches asunder, and upon the upper one reposes a tangent bar, on which the wheels run; these three essential parts are connected and braced by a system of radial posts, combined with diagonal braces; the whole being cast in a conjoined mass, in lengths of ten feet. It is, in fact, a cast iron arch (with a level extrados) nine inches deep at crown, and twenty-one at spring, the skewbacks being joined by a wrought iron tie-bar upon the chord, to secure sufficient abutment.

The quantity of materials required for a mile of single track railway, upon this plan, with a pile foundation, as calculated by the inventors themselves, would be:

140 tons of *cast iron*,
20 tons of *wrought iron*,
1056 *oak piles*, of 11 to 17 inches diameter.

* An isometrical engraving of the *cast iron rail* under consideration, will be found in the American Railroad Journal, for July 15th, 1841, accompanied by a very lucid description, written by the inventors themselves, and this engraving and description have been further circulated through the country in a descriptive memoir, issued in pamphlet form, by Messrs. Spaulding & Isherwood, for the information of the public. Those who feel an interest in this matter can easily refer either to the valuable periodical above mentioned, or to the descriptive pamphlet of the inventors—copies of which they would, doubtless, furnish, for the information of any who might contemplate the use of their rail. Com. Pub.

The amount of wrought iron was originally designed to be fifteen tons per mile, but additional cross ties have since been judiciously proposed by the projectors, to strengthen the rail against lateral action.

In the Railroad Journal, for July 15th, 1841, we find a detailed account of this rail (as originally projected,) illustrated by a very lucid isometrical drawing, which seems to render unnecessary a more particular description by us; and to this we refer those who wish to examine more minutely into its structure.

A railway constructed upon this plan would consist, in chief, of a series of cast iron arches, of ten feet span and one foot rise—each line of rails forming, indeed, *a continuous arched bridge*, in which the thrusts of the separate arches would be neutralized by the chord bars, and which would be kept in place laterally, by direct and diagonal transverse ties, of wrought iron.

This mode of constructing bridges of cast iron, *is not novel;* it is, in fact, the same in principle as that executed in the bridge which carries the London and Birmingham Railway over the Regent's Canal, near Chalk Farm; and the same idea—that of springing arches of cast iron from wrought iron tie-bars, secured to their skewbacks—has been put in practice on other English railways. (See Brees' Railway Practice, and Simms' Public Works of Great Britain.)

But the actual application of the trusses of such bridges, in a continuous line, to form the rails of railways, *is new*, (though the mere suggestion of a similar plan has been before made,*) and upon this adaptation of a known method of construction to a new use, must rest *the claim to novelty* of the rail under consideration.

Messrs. Spaulding & Isherwood propose to establish their cast iron superstructure upon foundations of oak piles, each from eleven to seventeen inches in diameter, and to be firmly driven by a ram of 1200 lbs., with twenty-eight feet fall.

In answer to a letter addressed by us to the inventors, they state: that twenty feet lineal of single track, upon this plan, has been for eight months in use, upon the Ithaca and Owego Railroad, daily traveled at a pace exceeding ten miles an hour, by an eleven ton, six-wheeled locomotive, with passengers and freight in trains of ninety tons average weight—amounting in all to about 24,000 tons gross, transported over these rails; that no rails have yet broken; that the piles do not settle; that the freight referred to was carried in cars without springs: and, that this part of the track remained wholly free from snow, when other portions of the same road were deeply covered.

The inventors also inform us, that, with an hydraulic press, they tested the strength of two patterns of their rail—each of ten feet span.

The first, weighing sixty pounds per yard, broke in its *lower arch*, under a weight of twelve tons; but the upper arch and chord bar

* Some years ago, Henry R. Campbell, Civil Engineer, of this city, proposed to use each separate truss of a cast iron bridge as the sustaining part of a line of wrought iron rails—designing, in this manner, to pass the Schuylkill river, near the city, with spans of 125 feet; which, like those of the plan before us, were to be retained in position laterally, by wrought iron tie-bars, and which was equally to be without a floor.

were not broken, until the latter (one inch in diameter) was torn asunder by augmenting the strain.

The second, weighing seventy-eight pounds per yard, (the same as those in trial on the Ithaca and Owego Railroad,) and having a one and a half inch chord bar, sustained twenty, but fractured in its *lower arch*, with twenty-two tons weight—though even then it did not fall down.

These experiments show that this rail, when of the weight of seventy-eight pounds to the yard lineal, possesses abundant vertical strength for railway purposes, and its practical use upon the Ithaca and Owego Railroad—as far as it has gone—is quite satisfactory, as we are informed, though we have also received intelligence, from a correct source, that in a similar experiment tried upon the New York and Erie Railroad, two rails were fractured at the ends, after a very brief use indeed; and it is evident that the amount of the passing trade, in the former case, has not yet been sufficient to fully test its merits.

As this structure is designed to stand in relief, about two feet clear of the ground, no one in a northern climate will lose sight of the advantage it will therefore possess in being easily kept clear of snow; and in the passage of small streams, or such as are not exposed to heavy drift, this railway will form a bridge for itself, without requiring the aid of a particular building for its use.

In curves, these rails will form a succession of chords of ten feet, and as piles, or any similar supports, of less base than altitude, present of themselves but little lateral stability, it would seem probable that the constant impinging of the wheels in the multangular line formed by the series of chords—especially in curves of small radii—would render the maintenance of the way difficult in such places, if, indeed, fracture did not result from this action, (notwithstanding the transverse ties,) owing to the apparent weakness of the rails in the centre; but actual experiment alone can determine what value there is in this objection.

The great depth of the rail at the skewback, will, in case of the subsidence of any pile—the rail revolving upon the opposite springing line as a fulcrum—cause the adjacent joints to open at top, to an extent at least double of what would result from the same settlement in an ordinary rail on detached bearings, three feet asunder; besides, bringing a strain on the subsiding joint well calculated to produce fracture. All which is certainly objectionable.

The risk of accident upon a decaying pile road, laid with these rails—in consequence of their elevation from the ground—ought not to be overlooked; for experience shows that in the general repairs of railways, timbers are not always renewed before they fail, though life should pay the forfeit of neglect: and hence it would seem, that a due regard to public safety would require that the timbers of such roads should be (if possible) protected from decay; but this would considerably enhance the cost per mile.

If within reasonable limits of cost, the consecutive arches of such a structure could be established upon solid, unyielding, and indestructi-

ble piers, it would then become an economical cast iron bridge, with a series of small spans, *and its complete success on tangent lines could not be doubtful;* but the Committee, as at present advised, are strongly inclined to the belief that, under the usual circumstances of railways, it would be difficult, if not impracticable, to procure, at a sufficiently moderate expense, that stability of foundation which, in their view, seems indispensable to the success of such a plan.

Finally, we will conclude by observing, that as the most serious objections to this rail involve considerations of comparative working cost, and as these can only be determined by experiments on *a sufficient practical scale*, we hope that the means will be afforded by some of our railway companies, to enable such trials to be made under the direction of the ingenious projectors—both on short curves and high embankments, and in the passage of streams—for the rail in question evidently has enough vertical strength, and possesses other important advantages, sufficient to recommend it for impartial experiment; but though there is strong reason to hope for successful results, *the Committee are not yet prepared to advise its general employment upon railways.*

By order of the Committee,

April 14*th*, 1842. WILLIAM HAMILTON, Actuary.

Note by one of the Collaborators.

The successful application of cast iron to form the rails of railways —which is even now a desideratum—will, when the admission of foreign railway iron, *duty free, shall cease*, evidently become of such importance in this country, that the experiments upon Spaulding & Isherwood's ingenious cast iron rail, which are now in progress in the state of New York, have deservedly excited considerable interest. Its vertical strength is unquestionable—indeed, far superior to that of any rolled iron rail, of the same weight, now in use—and it is to be hoped that those gentlemen will persevere in their trials and modifications of the pattern, until the properties of the invention shall be fairly developed by practice.

To enable the cost of this cast iron superstructure to be compared with that of the seventeen railway tracks of rolled iron, of which we compiled an estimate in the last volume of this Journal, page 158, the following is submitted:

Estimate of the probable Cost of a Mile of Single Track Railway, upon the Cast Iron Arch plan of Messrs. Spaulding & Isherwood.

140 tons of *cast iron*, from the Blast Furnace, delivered upon the line of road, at, say $45, per ton, .	= $6300 00
20 tons of *wrought iron*, ties, &c., complete, at, say $100 per ton, ...	= 2000 00
1056 *oak piles*, including delivering, driving, &c., and laying the superstructure, as estimated by Messrs. S. & I., conformably to the known expense of piled roads,	= 1500 00
Total, ...	= $9800 00

If this estimate is not incorrect, it would seem that the *cast iron arched railway* is likely to be more economical, in first cost, than the usual superstructure of rolled iron edge rails—to the extent, at least, of the saving in embankment, drainage, &c., which may be effected by the former. M.

Calderhead's Carpet Loom.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination an improvement in the Loom for weaving Carpets, &c., invented by Mr. Alexander Calderhead, of Philadelphia, Pennsylvania, REPORT:

That Mr. Calderhead's loom is a material modification and simplification of the Jacquard and other draw looms, for weaving carpets and other figured cloths. It dispenses with all machinery above the working parts of the common loom, and is thereby so reduced in height, that it may readily be placed in a common apartment without requiring the removal of the ceiling. The *harness* consists simply of *heddles*, or heilds, made of wires, about twenty-four inches long, and each pierced with an eye, for a thread of the warp to pass through, in place of the mails, twine, and leads, of the Jacquard harness. The heddles work vertically, in holes through two boards, or plates, resembling cumber-boards, the upper of which may be called the *rest-board*, and the lower the *guide-board*. The heddles have each a head at the top, which prevents their falling through the rest-board, and enables it to raise them when raised itself. The *cylinder*, or trunk, is a four or six-sided long and slender box, with pivots at the ends, and it extends horizontally across the whole width of the loom directly beneath the heddles; it is pierced on each side with holes corresponding to those of the cumber-boards, and the *pattern-cards*, or apron, rest upon it, and revolve with it—so that when the cylinder is raised and the rest-board lowered, the blanks of the card raise the proper heddles, while the remaining ones drop through the holes of the card, and of the cylinder beneath it, to form the sheed, or opening, for the shuttle to pass through. Thus the width of the sheed is equal to the distance which the heddles penetrate into the cylinder, and the upper and under threads of the warp are stretched alike. The cylinder turns on bushes, in a frame which slides vertically, and which, being raised by levers connected with the treadle, raises the cylinder. But the cumber-boards slide vertically and separately in the same frame, and the cylinder as it rises lifts the guide-board, with a part of the heddles; but the sliding frame acts upon two levers, supported from the cross-beam above, and thereby lowers the rest-board, and allows the proper heddles to descend into the cylinder. The guide-board is suspended from the rest-board, so that it cannot fall too far below it when the cylinder descends; and by means of a wheel at the end of the cylinder—having as many inclined teeth as the cylinder has sides, and these teeth acted upon by a kind of ratchet hooking against them—the cylinder as it descends is turned, so as to bring the next side uppermost, and bring the next figure of the pat-

tern cards into operation when the cylinder is raised again. By means of a like wheel on the other end of the cylinder, its motion may be reversed, and the pattern moved in the opposite direction.

The Committee believe the whole contrivance above described to be original, and exceedingly simple, ingenious, and effective, costing less than the machinery for which it is proposed as a substitute, in the outset, and producing a considerable saving in subsequent repairs of the twine required in other harnesses. The inconvenience arising from the stretching of the twine, is in this loom entirely avoided. It is alike adapted for cumber work, where the figure varies throughout the whole width, and point work, where the figure is symmetrical. It may be used for fabrics of two or more plies, or thicknesses, and requires for them merely a single pattern. The only objection to its use which has occurred to the Committee, is, that the fly or downy matter from the warp may in time clog the cylinder; but if this should be the case, that part may be easily removed and cleaned out, and there is little reason to apprehend any difficulty from this source. The committee would warmly recommend this invention to all manufacturers of carpets and figured fabrics, while they accord high praise to the meritorious inventor.

By order of the Committee,

June 9th, 1842. WILLIAM HAMILTON, Actuary.

Practical & Theoretical Mechanics & Chemistry.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the Comparative Value of various forms of Chimney Caps and Ventilators. By THOS. EWBANK *and* J. L. MOTT.

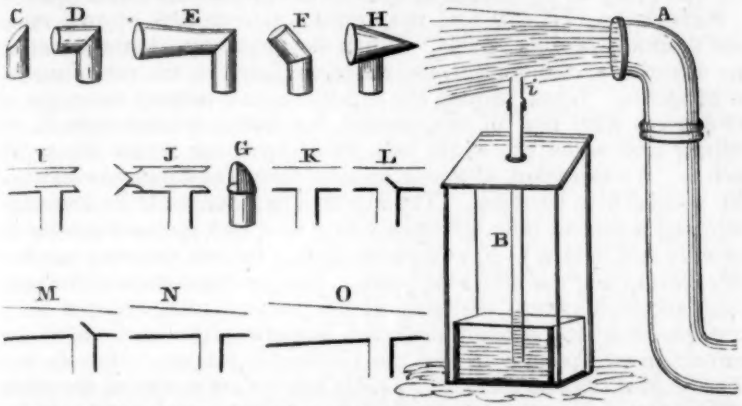
TO THE COMMITTEE ON PUBLICATION:

Gentlemen—The following experiments by Jordan L. Mott, Esq., and myself, are submitted for insertion in the Journal of the Franklin Institute. Yours, respectfully,

New York, July 1st, 1842. THOMAS EWBANK.

The object of these experiments was to determine the comparative value of various forms of chimney caps and ventilators. To do this with a tolerable degree of precision, a uniform current of wind of sufficient volume and force, was necessary; and it was equally requisite that the model of every cap tried should be placed in the same favorable position in the experimental current. We endeavored to realize these conditions in the following manner: In Mr. Mott's iron foundry three cylindrical bellows, each twenty inches diameter, and thirty inches stroke, are employed; the pistons are moved alternately by a triple, or three throw, crank. From these bellows the ærial current, or blast, was derived; the wind from all of them was conveyed about twenty feet through a five inch pipe, where it issued in a horizontal direction through the tube A, whose orifice was three inches in diameter. To render the blast as equable as possible, the steam engine that worked the bellows was kept going at a uniform speed during

the time occupied in experimenting. The blast, however, was not, after all, very uniform, and the consequence was a slight oscillation of the water in the gauge that measured the results.



Eight inches from the open end of the blowing pipe, A, a glass tube, B, an inch and a quarter bore, and twenty-eight inches long, was secured in a frame. Its lower end descended into a vessel of water, as represented, and to its upper end was fixed a ferrule, *i*, of tin plate. To this ferrule the vertical tubes of the caps were accurately fitted, so as to be slipped on and off without disturbing B. The models were made of tin plate, and the vertical tubes attached to them were all of the same dimensions, viz: 1½ inch long and $1\frac{3}{16}$ inch bore. The glass tube which may be supposed to represent a chimney, was designed, as the reader will have already perceived, to measure the degrees of rarefaction produced within it by the caps—the ascent of the fluid indicating the effect of the blast of wind on each. Except when otherwise noticed, the axes of the caps, or horizontal tubes, were made to coincide with that of the current. With the view of verifying the general results, and to detect any variation in the force of the blast, from slight changes in the speed of the steam engine, the experiments with each cap were repeated, at short intervals of time, but no very obvious changes in the results here recorded were observed.

Experiment I.—The first experiment was with the tube B, as figured in the cut. It was raised till the orifice of the ferrule was in the centre of the blast; but in no part of the current was any rarefaction produced. The water was neither elevated nor depressed within the tube. Had the upper end been inclined towards A, wind would have entered and displaced the water from the bottom of the tube; and, on the other hand, had it been inclined in the opposite direction, a slight ascent of the fluid would have followed; but it was not deemed of sufficient importance to try either.

Experiment II.—The tube C was now slipped on the ferrule in the position in which it is figured. It will be perceived that at the side away from the blast, a portion is removed, as if to form with a

similar tube a mitred joint, or a right angled elbow. With this device the water rose in B from 1¾ to 2½ inches above its level in the vessel. By turning the open part of C till it was nearly parallel with the blast, little or no change in the extent of rarefaction took place.

EXPERIMENT III.—D was next tried. It consisted of two tubes like C, united at right angles. When the horizontal branch was in the direction of the current, the water oscillated in the tube from 1½ to 2¼ inches. Upon turning the cap till its axis formed an angle of 45 degrees with that of the current, the liquid column rose to 3¼ inches; and when the angle was 90 degrees, the water fell to 2½ inches. An elevation, however, greater than was obtained when the cap ranged with the blast. The cap was next turned to its first position, and a conical tube, six inches long and two inches diameter at its wide end, added to it, as figured at E. To our surprise, no further elevation of the fluid took place. The central current of the blast being received against that part of the vertical tube opposed to it, was, probably, too strongly deflected to allow other portions of the current to sweep close around the horizontal branch. Had the cap D resembled the one marked F, there can be no doubt of the effect being increased, as the wind would then embrace, and impinge upon, a larger surface. Unfortunately we had not prepared any models of cylindrical caps at various angles, i. e., where the caps proper were inclined upwards like F. The next figure exhibits an approach to this plan, and when compared with C, which it so nearly resembles, exhibits a decided improvement.

EXPERIMENT IV.—The cap G consists of a vertical tube, with a head piece extending over three-fourths of its upper, or discharging, orifice. The back of the hood, which receives the blast, forms an angle of about 30 degrees with the side of the pipe to which it is attached. This cap raised the water in B from 3½ to 4½ inches, being double the elevation which C produced. Deviating the position of the opening, with regard to the current, diminished the effect.

EXPERIMENT V.—The conical cap H was now placed in the blast, upon which the fluid ascended in B from 2½ to 3½ inches. Three models of this cap were tried; they were all of the same diameter at the mouth, and the vertical tubes were attached to them at the same distance from the mouths, viz: three-eighths of an inch; but their lengths varied, being respectively 3, 3⅜, and 3⅞ inches. There were no very observable variations in the altitude of the liquid column produced by them, but the only one that raised it to 3½ inches was the longest—the one last named. When the mouths were turned till the axes of the cones formed an angle of about 45 degrees with that of the blast, the water commonly fell in the tube, though not uniformly so; but what appeared singular, when the axes of the cones were at 90 degrees with the current, the water actually rose to 4½ inches! On several trials this unexpected result followed.

EXPERIMENT VI.—The next experiment was with the cap figured at I. The model was made from caps on sale in the city. The outer pipe, or case, was 4⅞ inches long and 1½ inches bore. The inner tube was three-fourths of an inch bore, and with the conical

ajutage to catch the wind, 2½ inches long. This cap raised the water 4½ inches. When its axis was a little inclined to the blast, no sensible change in the elevation of the water in B followed; but when the angle with the axis of the blast was at 45 degrees, the water fell to 3½ inches, and at 90 degrees the water stood only at half an inch. (This, and the remainder of the figures, are in section.)

Experiment VII.—The inventor of the last cap has applied near its open end (by two or three strips) a cone, as represented at J. The object of this is to prevent currents of wind entering that end, and so driving the smoke down the chimney, instead of drawing it up. To ascertain the effect of this arrangement on the exhausting power of the cap, the model J was made in all respects the same as I, the cone excepted. On applying it to the current, the water rose in B to an elevation little more than half of that produced by I, being only 2¼ inches. When the cap was turned to 45 degrees, the water fell to 1¼ inches, and at right angles it sunk to a level with that in the vessel. This effect might in some degree have been anticipated, since the wind would, in being thrown from the sides of the tube, be apt to catch hold of the cone, and be turned into the cap. On this account, the base of the cone should not project in the least degree over the mouth. The cone, too, retards the free exit of the smoke.

Experiment VIII.—The next devices tested were such as I have applied to charge siphons, and also for producing a vacuum by currents of steam—the model marked K consisting of a horizontal and perpendicular tube of the same bore, united at right angles. The horizontal one was 2½ inches long. On placing this cap on the glass tube, no rise of the water took place, but rather the reverse, for portions of wind descended and drove out the water occasionally. When the axis was inclined nearly 45 degrees to the blast, the water *rose four inches*. At right angles it was at two inches.

A projecting piece was now placed within the cap, so as partly to cover the orifice of the perpendicular tube; (see next figure, marked L.) On trying this, the water rose 4½ inches; inclining the cap raised it to 5½ inches; as the projecting piece retarded the current through the tube, it was pressed down to make the passage way larger, upon which the water rose a little higher. Various conical ajutages were now tried, as figured at M, and with one six inches long, and two inches diameter at the wide end, the water rose 8½ inches. No additional rise of the column was obtained by changing the position of the cap within the current.

Experiment IX.—The same cap was now tried again, but with the projecting piece entirely removed, (see N.) The water now rose 15 inches, and oscillated from 13 to 15. A short conical tube, whose mouth flared out to two inches, was next inserted into the small end of the cap, with a view to draw more air through it; this caused the liquid column to ascend at once to 18 inches. A longer tube, whose mouth reached to the orifice of A, caused the water to rise entirely out of the tube—28 inches! These increased effects, it will be remembered, are caused by an *interior and exterior* blast—the wind sweeping *over*, as well as *through*, the cap.

EXPERIMENT X.—A cap, precisely the same as the last, except the horizontal one, being 1½ inches bore, and as figured at O, raised the water to 18 inches, and kept it oscillating from 16 to 18. The short diverging mouth piece mentioned above, was applied to the receiving end of the cap, and raised it from 22 to 24 inches!

From these experiments it would seem that a chimney cap, or ventilator, made like the last figure, is very far superior in its effects to any other yet known; and, what is of some consequence, the form is almost as simple as the simplest. A diverging tube might be attached to the end which receives the current, but the mouth of this should not greatly exceed the diameter at the junction with the vertical tube: if it did so, it would diminish the effect of the wind, in sweeping along the sides of the discharging branch. The under side of the receiving end of the cap should project beyond the upper one, in order to catch the descending currents more readily. This feature is figured at N and O.

Perhaps some readers of the Journal may find time to repeat and extend these experiments. There are several old chimney caps which have not been included, especially *revolving* ones. At the first favorable opportunity, we will, if not anticipated, pursue the subject.

Notice of the Use of Auxiliary Steam Power in Propelling Vessels.

The small steam engines fitted in the "Vernon" and "Earl of Hardwicke" Indiamen, to try the advantage of small auxiliary power to propel merchant ships during calms and light winds, have been removed. This experiment may, therefore, be considered a failure, for although less time was occupied in the voyage, the loss of room for freight, together with the expense, more than counterbalanced the advantages.

New and Simple Method of Obtaining Mezotint Grounds.

It gives me some pleasure to be able to announce that I can form a tolerably good mezotint ground on a plate, by passing it along with a piece of common sand-paper five or six times through the rolling printing press, with rather a tight pressure. The depth of color, when printed from, does not quite possess the intensity of those executed in the usual manner; but the method answers exceedingly well for prints which it is intended to finish in colors.

I remain, &c.

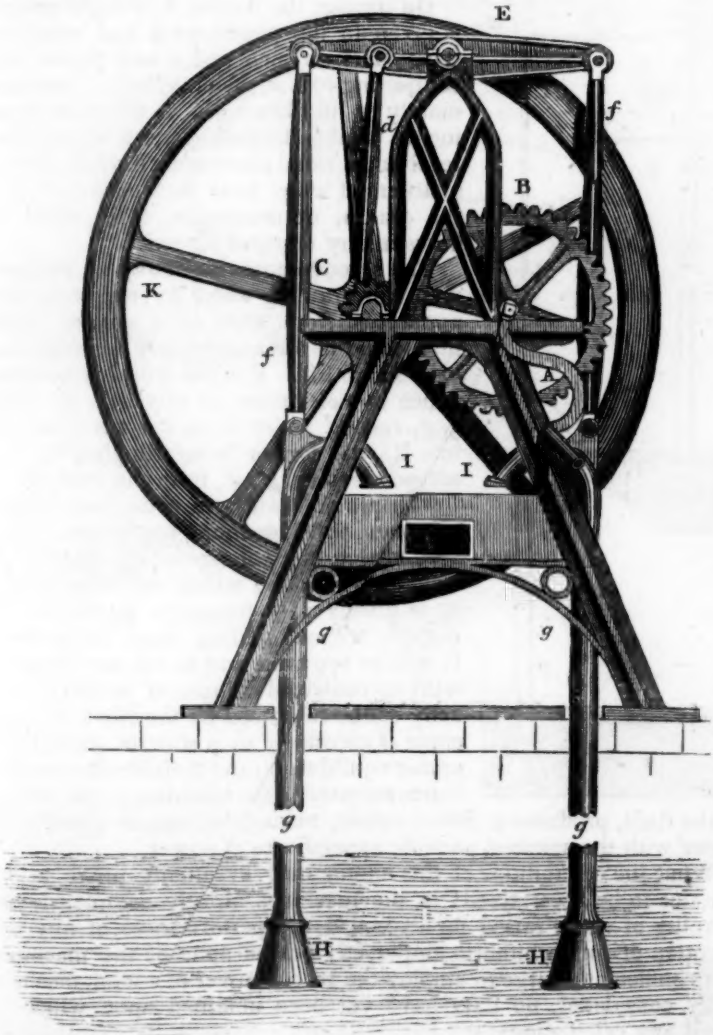
LAURENCE BRUNTON.

March 14, 1842.

Mech. Mag.

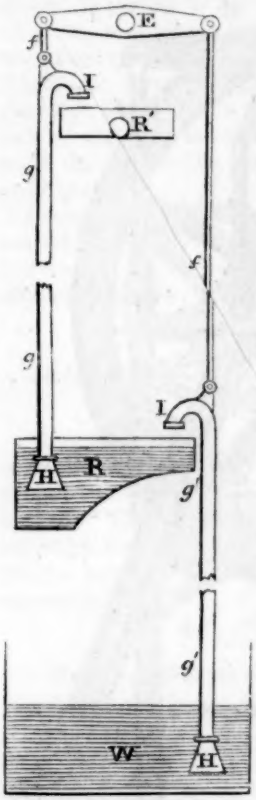
Walker's Hydraulic Engine.

Mr. Walker's apparatus depends for its action upon the momentum acquired by fluids when in motion; several of them have been completed to be worked by manual power, or by wind, and forwarded to climates where machinery for this purpose, constructed of less durable materials, has been found a subject of continual annoyance and expense.



The above engraving represents one of Mr. Walker's Elevators, in its complete form. A is a winch-handle on a shaft, which carries a

toothed driving-wheel, B, working into a pinion, C; upon the pinion-shaft there is an eccentric, from which a connecting-rod, *d*, passes up to the over-head beam, E. From each extremity of the beam E, two pump rods, *f, f,* pass down to the two elevators, or water cylinders, *g, g,* which may be of any convenient length, say from thirty to forty feet, and from one and a half to three inches in diameter; these cylinders are closed at their lower extremity, H, by valves opening upward.



On turning the handle A, a rapid motion s given to the pinion-shaft and eccentric, which has an inch and a half throw; the connecting-rod, *d*, being attached intermediately to the beam, E, a throw of three inches is given to the elevators, which, thus receiving a rapid alternating motion, deliver a stream of water from their nozzles, I, into the cistern, or receptable, from which it flows in any required direction.

The second engraving shows an arrangement for drawing water by means of this apparatus, from wells of a greater depth than could be advantageously accomplished by a single lift. E is the working beam to which two elevators are attached, the first, *g, g,* raising water from the reservoir, R, into R', the former being supplied by the second elevator, *g', g'*, from the well, W.

The pinion-shaft is in some cases fitted with two, three, or more, eccentrics, which give motion to a corresponding number of elevators contained within the same frame, so as greatly to increase the power of the engine, without adding much to its bulk. It will be apparent that as the one elevator, with its contained column of water, is exactly counterbalanced by the other, the machine is constantly in a state of perfect dynamic equilibrium, and therefore the motion communicated to the machinery, and thence to the fluid, produces a direct action, raising the largest quantity of water with the smallest possible expenditure of power.

What the capabilities of this engine may eventually prove to be, remains to be ascertained; in the machines already completed, the quantity of water raised far exceeded the performances of any description of pump hitherto employed; but as none of the machines were sufficiently large to employ the whole power of a man, mechanically considered, no data have yet been obtained upon which to found any calculations.

Mech. Mag.

Improvement in Slide Valves.

Fig. 1 is the section of the cylinder valve, piston, &c. A, represents the piston; B, the piston rod; C, the cylinder; D, slide; E, valve spindles; F, bottom steam passage around the cylinder; G, bottom exhausting passage; K, top exhausting passage; L, top steam passage.

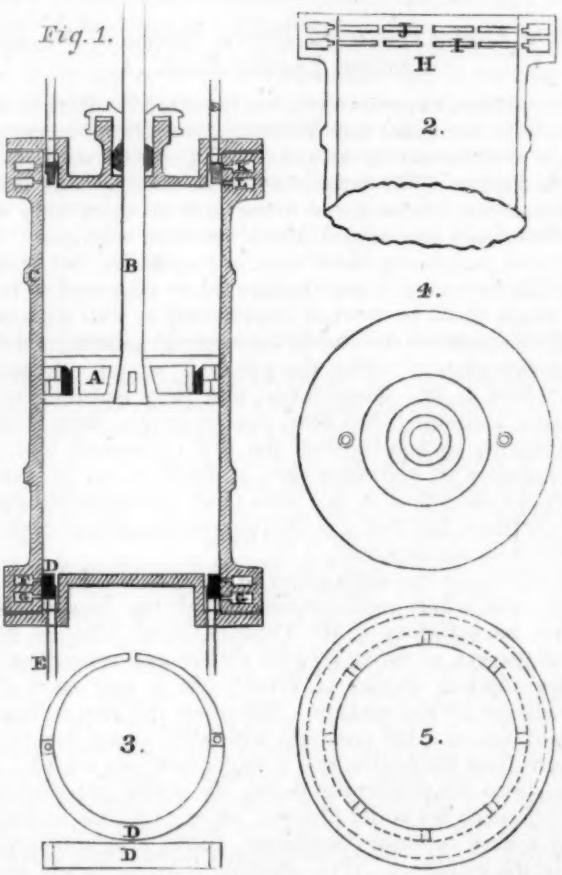


Fig. 2. H is intended to represent a section through the ports, and steam passage, &c.; I, is the steam port; J, the exhausting port.

Fig. 3. D represents the valve, being a round ring.

Fig. 4 is the top view of cylinder cover.

Fig. 5 is top view of cylinder through the ports, showing the ribs.

The utility of this valve consists in giving steam much quicker, in consequence of the ports being all round the cylinder, and the valve traveling, therefore, about one-tenth part the distance of the common D slide valve. It does away, also, with a deal of work, such as the

D valve, valve jacket, packing blocks, &c. The steam may be also, by this means, worked expansively to a greater advantage than at present, as it is necessary to have an additional expansion valve for the present D valve, when it is desired to work steam expansively.

THOMAS MERITON.

Mill Wall, January 27, 1842. Ibid.

New Steam Engine erected by Messrs. Rennie, at Mr. Cubitt's Factory, Thames Bank.

The two-cylinder, expansive engine, invented by Hornblower, and afterwards, with but slight modifications, brought into extensive use by Woolf, is well known to all persons acquainted with the history of the steam engine. The cause, also, of its subsequently falling into disuse, is no secret; it was found to perform no more duty with two cylinders than could be done, at much less cost, with one. Not that more duty was *previously* done with one cylinder, but that in the progress of improvement it was discovered, or supposed to be discovered, that steam could be worked expansively as well with one cylinder as with two; and so the cost of the second cylinder, and the extra friction and radiation attending the use of it, saved. Abandoned in Cornwall, where it first found favor, and long maintained a strong hold on public opinion, it has now, strange to say, been re-produced in the metropolis, by engineers of the first eminence; and, stranger still, with a degree of success which, if there be no mistake in the case, shows not only that it has been most undeservedly shelved by its Cornish patrons, but that it is in truth the best sort of engine which has ever yet been constructed.

The engine which has thus taken the engineering world by surprise, is one which has just been erected by the Messrs. Rennie, at the extensive manufactory of Mr. Thomas Cubitt, Thames Bank. It differs in no respect, as far as regards details and arrangement, from the ordinary rotative engine of Woolf; nor is any such difference claimed credit for by the makers. There are the two cylinders, side by side, as of old—a small one, into which the steam first passes at a high pressure from the boiler, and a larger one, into which it expands (five times;) also the ponderous beam, fly-wheel, rotating shaft, &c. The only difference we could observe, consists in the workmanship, which is of a very superior description, and in a little better clothing (perhaps) of the cylinders. The effective working power is stated to be equal to sixty horses, and the consumption of fuel to be *no more than 2.2 lbs. per horse power per hour.* It is this which is the startling result. So small an expenditure of fuel has never been before reached by any rotative engine, of any description; not even by the same sort of engine, when in the friendly and fostering hands of Woolf. That it has been actually realized in the present instance by virtue merely of better workmanship and better clothing, no person can be expected to believe, except on the most indisputable evidence; and such evidence the respectable manufacturers of the engine will, no

doubt, themselves allow, still remains to be furnished. We were assured that it was doing the same work which two or three old engines, of the cumulative power of sixty horses, had been in use to perform, and have no reason to question the fact; but that, evidently, is a very uncertain test of its real power. We were also shown indicator diagrams, which exhibited a very small average deficiency of pressure; but the insides of steam cylinders and working shafts, as all the world knows, often tell very different tales. The means taken to keep a correct account of the quantity of fuel consumed (Welsh coal) appeared to be also most unexceptionable; and if we could only admit sixty to be the proper divisor to employ, we make no doubt of 2.2 lbs. per horse power per hour being a true result. Proof, however, of the sixty horses' power is still wanting—such direct and positive proof as *actual performance* alone can supply, and that not during short trials of an hour or a day at a time, but during trials carried on for several days successively, and under the same circumstances, precisely, in all respects. Ibid.

Condensation of Steam by Cold Air. Craddock's Process.

The peculiar feature of my invention is, the communication of a rapid motion to the condenser—independent, of course, of the motion which the vessel or locomotive may have, to which my condenser is attached. It will be unnecessary for me to detail my preliminary experiments, or the various forms which I have given to the condenser during my investigations; I will, therefore, at once, describe the apparatus in that form which, from my present experience, seems to me the best. A hollow axis is supported by proper bearings, in a vertical position. The lower end, or that at which the steam is introduced, is open, and works on a pivot fixed on the bottom of a chamber, on the top of which is a stuffing-box, through which the axis passes. Near the upper or closed end of the axis is an enlargement, or chamber, from which proceed, at right angles to the axis, a number of radial hollow arms, into each of which the ends of a series of small copper tubes are inserted; these, of course, are parallel to the axis; their lower ends are inserted into other radial arms fixed near the bottom of the axis, and similar to those at top, excepting that their ends do not open into it. The radial arms at the bottom are all connected by their ends opening into an annular chamber. A rapid rotary motion is given to the condenser by the steam engine to which it is attached, the result of which is the cooling of the apparatus, and, consequently, the condensation of the steam which has been introduced into the small copper tubes. The condensed steam, or water, falls into the lower radial arms, and is thrown from thence into the annular chamber by centrifugal force; a small pump is affixed to this chamber, and its piston-rod is attached to the clip of a fixed eccentric, supported round the movable axis of the condenser. As the pump travels about this eccentric, its piston-rod works to and fro, and the water is removed from the condenser. The arrangement of the minor parts of

the apparatus, such as the conveyance of the water to the boiler, the connexion of the air-pump, &c., cannot be illustrated without drawings. I may just remark, here, that the force-pump for the removal of the water is not absolutely necessary, as the air-pump may be made to effect that object. My experience, however, demonstrates that it is effected to greater advantage by its use.

I have attached a condenser of this kind to a high pressure engine of five horses' power, and, by giving it a velocity of eleven miles per hour, the water is drawn off at a temperature varying, with that of the air, from 90° to 120° Fahr. The column of mercury supported by the vacuum is not quite so high as it should be, according to the temperature of the water; this, however, is owing to the imperfection of some of the joints in the condenser, and will soon be remedied. The power gained is more than double that required to work the condenser and air-pump. The amount of surface required to condense a given number of cubic feet of water per hour, depends on the velocity at which it is intended to work the condenser, and the temperature at which the water is drawn off. It does not appear to me advisable to draw the water off at a temperature lower than 150°, for a given abstraction of heat at lower temperature affects the height of the mercurial column much less than at a higher; and any one familiar with the law according to which heat passes from one body to another, need not be told that the same surface will condense much more steam into water at 150° than at 100°. A condenser having a velocity equal to twenty miles per hour, and the water being drawn off at 150°, will require about twenty square feet of surface per cubic foot of water per hour. The strength of the copper I have hitherto used is one pound to the square foot, but I intend using it much lighter in future. The weight of a condenser equal to condense ten cubic feet of water per hour, will be from eight to ten hundred weight.

Besides the advantages which my mode of condensation possesses, in those situations where a supply of water cannot be had, I believe it possesses other, and scarcely less important, ones. By my condenser returning the water to the boiler, I am enabled to use a tubular boiler, without experiencing that inconvenience which almost precludes their use, in combination with the ordinary system of condensation, namely, the liability to become choked up by the deposit from the water. Although the condenser with which I am working is far from being tight in its various joinings, I have worked my engines constantly for four days, without adding any water to the boiler; and I have no doubt that the condenser and engine I am now fitting up, and to which I hope very soon to be able to call the attention of engineers, will give results even more satisfactory than those at present obtained.

THOMAS CRADDOCK.

Ibid.

Mechanics' Register.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1841.

With Remarks and Exemplifications by the Editor.

1. For improvements in machinery for *Hoisting Weights, &c.;* John B. Holmes, Boston, Massachusetts, June 7.

In this machine the rope, or chain, to which the weight is suspended, winds around two grooved drums, to each of which there is attached a cog wheel, mashing into a pinion that lies between the two, and by which they are actuated, the two cog wheels having the same number of teeth, to insure the same motion to the two drums. These drums, together with their cog wheels, project outside of the frame, one of them turning on a spindle attached to the side of the frame, and the other on a spindle which passes entirely through it—the part of it which is within the frame being adapted to receive one of a train of wheels for multiplying the power. One of the drums has cogs cut upon its outer edge, which take into the teeth of a pinion on the axle of a grooved roller, for the purpose of making pressure upon the rope, or chain, to prevent its slipping.

Claim.—"What I claim as my invention and improvement, and desire to secure by letters patent, are—First, the arrangement of the barrels which hold the rope without an outside framing, as described. Second, the combining therewith, in the manner set forth, a grooved roller, to press the rope against the barrel on its passage therefrom, for the purpose of preventing any slipping of the rope which the action of the weight at the other end has a tendency to produce—being constructed and operating as described."

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2. For an improved mode of *Block Printing* on various kinds of Fabrics, and for Apparatus, &c., for that purpose; Robert Hampson, Manchester, England, June 7.

The printing block is attached to a cross frame, which slides on straight edges at the four corners of the main frame, and has a rod attached to its middle that slides through a hole made in a set of arms at the top of the main frame. To the upper end of the rod there is a band attached, which passes over two pulleys, and has appended to it a counter weight, to balance the whole.

The fabric to be printed is drawn through the machine, and over the bed on which it rests, to receive the impression, which is given by means of blocks, in a manner well known to machinists. The colors are so arranged in separate sieves as that they can be drawn apart to receive new colors, and then brought together again to apply the colors to the block; the sets of sieves are placed upon a platform provided with wheels, running on rails. The platform, with the colors, is passed under the block, which is then let down to receive that which is wanted. The sieve is then drawn away, and the block de-

scends upon the fabric, to impress the pattern; and the operation is in this manner repeated.

Claim.—"I declare that I claim as of my invention the apparatus, or machinery, constructed as set forth, for printing with blocks on woven fabrics of various kinds; that is to say, I claim the combining of a block for printing in various colors with the apparatus, or mechanical agents, for causing said block to descend in a perpendicular direction in order to take up the color from the sieve, or sieves, and to impress the pattern, or design, upon the fabric; said apparatus, or mechanical agents, consisting of the cross frame, the arms, the straight edges at the corners of the main frame, the rod, the band, and counter weight, with their appendages; the whole being so connected as that by raising the counter weight the cross frame and block will descend, and the color be received on the block, or the impression given to the fabric; and I claim the same however the said mechanical agents and contrivances may be modified or varied in size, form, proportion, or other particulars not departing from the principle of my invention; but I do not claim as my invention such mechanical agents, or contrivances, separately, but only as combined to effect the purpose aforesaid; nor do I claim as part of my said invention the apparatus hereinbefore described for traversing the coloring apparatus to and fro, by means of a railway and carriage running thereon—the same, although invented by me, having been by me used and practised previous to the grant of the said letters patent; nor do I claim as of my invention the arrangement of rollers and connected apparatus for causing the fabric to traverse, or be drawn over, the printing table, and conveyed away when printed. And I further declare that I claim as of my invention such coloring apparatus as hereinbefore described, in which several sieves are separated and held apart, to admit of the several colors being distributed and traced, or spread, thereon, without admixture or interference one with another, and whereby the sieves are afterwards closed, or brought into juxta position, in order to the colors being taken up by the block, so as to produce at one impression of the block, or pattern, or design, or parts of a pattern or design, in several colors, arranged contiguous, or near to each other, as hereinbefore described; and which coloring apparatus I claim, whether the same be used in conjunction with the machinery before described, or with the common hand block, or otherwise, and under whatever other modification."

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3. For an improved mode of Framing and *Bracing the Arms of Paddle Wheels* of Steam Vessels; Wm. F. Julian, Hartsville, Bartholomew county, Indiana, June 7.

The arms are bolted to a cast iron centre plate, in the usual manner, and kept at equal distances apart, by wedges driven in between them. Two sets of braces are arranged between the arms, the braces being provided with short tenons, fitting into long mortises in their sides, the said mortises being sufficiently long to allow the braces to be drawn in towards the centre of the wheel. The two sets divide

the length of the arms, between the periphery of the outer plate and their outer extremity, into three parts. The centre plate has a flanch with notches, into which the arms fit, and the braces are drawn tight towards the centre of the wheel, by means of radius screw bolts that pass through their middle and the flanch of the centre plates.

Claim.—"What I claim, and desire to secure by letters patent, is the within described manner of inserting and drawing up the braces, by means of brace-bolts attached at their inner ends to the circular plate which receives the ends of the arms; said bolts being furnished with screw nuts, which are to bear against the middles of said braces, as described and represented; the braces being inserted and retained in place by means of short tenons, and left free to slide within the arms, as set forth. I also claim, in combination with the foregoing mode of bracing by means of the brace-bolts, the employment of the wedges between the inner ends of the arms."

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4. For an improvement in the machine for *Turning Straight, Curved, or Taper, Work*—such as Fork and Shovel Handles; Collins & Wistar, assignees of Stacy Costill, Philadelphia, Pennsylvania, June 7.

The piece of wood to be turned is fixed to a mandrel, and passes through a hole in a plate attached to a slide rest. The hole in the plate is provided with three segments that slide in radial grooves made in the plate for the purpose of regulating the size of the hole to suit the size of handle required to be turned. The segments are all moved together by a second plate, which has three eccentric grooves cut in it, that receive projections from the back of the said segments. The turning of the last mentioned plate at the back of the main plate will, therefore, cause the segments to approach or recede from the centre. The cutting is effected by a cutter attached by proper fixtures to one of the segments.

Claim.—"What I claim as of my invention, and desire to secure by letters patent, is the cutter in combination with the movable segments, and these thus combined in combination with the eccentric grooves in the plate, for the purpose, and in the manner, described."

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5. For an improvement in the *Key for Extracting Teeth;* Moses J. Hill, Bloomfield, Lagrange county, Indiana, June 7.

This patent is granted, as stated in the claim, "for combining a friction roller with the bolster of the ordinary key for extracting teeth, in such a manner as that said friction roller shall constitute the bearing part of the bolster in the operation of extracting a tooth."

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6. For an improvement in the *Saw Mill;* James B. Lowry and Philander Eggleston, the former of North East, Erie county, Pennsylvania, and the latter of Mayville, Chatauque county, New York, June 11.

This patent is for an alleged improvement on that kind of saw mills

in which two saws are used; but instead of being strained in a gate, they are attached to chains that are connected with two vibrating beams, the ends of which are segments of circles. The claim is confined to the combination of a slide and stirrup, by which the saws are attached to the chains, and by which they are guided.

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7. For an improved mode of *Fastening Doors on the inside*, called the "Traveler's Security;" Benjamin H. Green, Princeton, Mercer county, New Jersey, June 11.

This instrument is for fastening doors from the inside which are not provided with locks or bolts. Two claw pieces, one of which is put against the floor, and the other against the lower rail of the door, are united together by a right and left handed screw, provided with a thumb piece in the middle for turning it, and by which the claws are forced apart.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of constructing the traveler's security by combining the two claw pieces with an intermediate screw, furnished with a thumb piece for turning the same, as described."

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8. For an improvement in the *Bee Hive;* James Le Pataurel, Chandlersville, Muskingham county, Ohio, June 11.

The proposed improvement is in that kind of hive in which the honey is formed in glasses, and by which the patentee says he is "enabled to take out the honey, &c., from the hive, without destroying the bees, and without running any risk of being injured by them." The glasses are made with a stem which fits a hole in the cover of the hive, and are provided with a hole at top, and they are arranged in pairs at a suitable distance apart, to receive two pipes that branch out from a furnace for generating smoke. When it is desired to drive the bees from a set of glasses into the apartment below, the pipes are applied to the glasses, and a composition, consisting of 3 oz. of sulphur, 4 oz. of pitch or tar, 1½ oz. of tobacco, and ¼ oz. of grease, is put into the furnace, which generates a smoke that expels the bees. The glasses are then removed, and the holes closed by means of movable covers. When it is desired to drive the bees from one apartment to another, the pipes of the furnace are introduced through holes in the cover of that apartment from which they are to be driven.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the manner in which the glass bows, or hives, are combined and adapted to the apertures in the cover, by being formed with hollow stems, as set forth. I also claim the furnace constructed and combined with the hive, as set forth."

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9. For improvements in *Door Locks and Latches;* Geo. W. Wilson, Nashua, Hillsborough county, New Hampshire, June 11.

The claim in this patent rests upon the making of the lever, which acts upon the latch, with a heavy weight and disconnected from the

latch, so as to cause it and the knobs to return to a stationary position, and thereby, whenever the door is closed, to permit the latch to recede and advance independently of said lever; and also to the combination of this with a weighted, or gravitating, latch; to the combining with the main bolt of the lock another bolt, to be operated by an extra key; and to constructing the holding lever of the main bolt so that the key cannot be withdrawn unless the holding lever has been brought to its proper place; and, finally, to a peculiar apparatus for giving an alarm should any one attempt to open the lock; this apparatus consists of a slide, spring, and spring catch, to be used in connexion with the extra bolt, and which, when disconnected therefrom, starts the alarm.

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10. For improvements in the *Horse Power;* Samuel H. Little, Gettysburg, Adams county, Pennsylvania, June 10.

The patentee informs us that the improvements consist in the "manner of constructing this machine, by which it is made capable of being adapted to the power of two or four, or any other varying number of horses." The rim of the main driving wheel, with the cogs thereon, is cast separately from the arms, by which it is connected to the shaft, there being gains, or notches, cast in the inner side of said rim, into which the ends of the arms fit, and by which it is capable of being removed from one set of arms, and placed upon another set, of the same size. Immediately over the arms above named, and connected with them, are the sunken troughs which receive the horse sweeps. The weight of the wheel, arms, &c., is supported by conical friction rollers, which have their bearings in braces cast with the said arms. This wheel revolves on a stationary pivot rising from the cap of the machine, and gears into a pinion on the shaft of the second wheel. The upper ends of the shafts of the second and third wheels are adapted to receive the main wheel when it is desired to employ less power. The lower gudgeon of the shaft of the second wheel is received in the upper part of a standard projecting from the bed of the machine, and this standard is also adapted to the reception of a shaft, instead of this, provided at its upper end with arms and troughs for the horse sweeps; and at its lower end with arms for the main wheel; the said arms being also provided with conical friction rollers that travel on the upper part of the standard, which is made conical for that purpose. By these various arrangements this machine may be conveniently and readily adapted to the power of one, two, or more, horses.

The claim makes reference to the drawings, and is to the manner in which the cross, or troughs for the sweeps, the arms and rim of the driving wheel, and the friction rollers, are arranged and combined, so that they may be shifted from one shaft to another, and by which the wheel may be adapted to other arms of the same size; and also to the manner of arranging the extra shaft so that it may take the place of the shaft of the second wheel.

11. For improvements in *Marine Steam Engines;* Charles W. Copeland, New York, June 11.

The cylinders, in this arrangement of the engine, are inclined at an angle dependent upon the depth of the hold, and the length of stroke; and they are fastened to inclined beams extending from the paddle-wheel shaft to the kelsons, said beams being connected with the kelsons along their whole length, by other beams, and by bolts—the whole constituting truss-frames, which sustain and divide the weight and jar of the engines. The condensers are directly under the upper end of the cylinders, and the channel-plates run between the kelsons. The lower end of the air pumps, which are inclined, as well as the cylinders, are secured to the ends of the said channel-plates, and the hot wells to their upper parts; the delivery valves are placed on the upper side of the channel-plates. The pistons of the air pumps, in this arrangement, are solid; and the whole apparatus is rendered compact, and placed within the reach of the engineer. The side pipes are placed above the cylinders, the steam chests at each end thereof, and the valve stems running down in front of the heads of the cylinder to the rock shaft. The feet are attached directly to the stems, instead of lifting rods, and are acted upon by the toes of the rock shafts, the two rock shafts being connected together by a rod.

Claim.—"What I claim as new, and as constituting my invention, is, first, the placing of the cylinder in an oblique direction, with its lower end near to the bottom of the vessel, and allowing it to stand at such angle as is required for the connecting of its piston rod with the crank on the shaft of the paddle wheels, in combination with the condenser, channel-plate, and air pump, arranged and located as described. I do not claim the mere placing of the cylinder of a steam engine obliquely, as this has been done for other purposes; but as I produce a new and useful effect, by so placing the steam cylinder and its appendages in the combination above claimed, on board of vessels for navigating the ocean, I limit my claim to the so placing them under the said combination as to attain the object fully made known. Secondly, I claim the manner of arranging and working the steam and exhaust valves as set forth, the same being effected by a direct action, that is to say, without the employment of the lifting rods and lifters usually required for that purpose. Thirdly, I claim the manner of combining and arranging the condensing apparatus, the air pump being placed at the same angle, or nearly so, with the cylinder, and attached by its lower end to the channel-plate, the delivery valve being also placed on the upper part of the said plate; the combination intended to be claimed under the last head consisting in the arranging of the several parts enumerated, that is to say, the air pump, the channel-plate, and the delivery valve, substantially in the way described."

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12. For an improvement in the *Fulling Mill;* Sidney E. Coleman, West Haven, Rutland county, Vermont, June 11.

The cloth is put into the machine, with the usual folds, and passes

between rollers arranged in a box, which have different degrees of motion communicated to them by band wheels and bands, or by cogged wheels.

Claim.—"I claim as my invention, fulling cloth by means of revolving rollers, or cylinders, said rollers being arranged in a box, or casing, and operating as described."

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13. For an improvement in the *Saw Mill;* William Bryant, Nashville, Tennessee, June 11.

The saw gate and fender posts of this mill are placed at an angle of about 45 degrees with the plane of the carriage, instead of being perpendicular to it.

Claim.—"What I claim as my invention is, placing the guides which direct the saw at such an angle with the log, or timber to be sawed, that the shavings in being cut are peeled, or raised, and carried forward by the teeth of the saw, in the lengthwise direction of the timber sawed."

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14. For an improvement in the *Rotary Steam Engine;* Hernon Smith, Sunbury, Delaware county, Ohio, June 11.

In this rotary engine there are two pistons on opposite sides of the wheel, or drum, each being united by a rod passing through the diameter of the wheel, said rod being provided with a loop in the middle, to pass over, and slide on, the shaft. This double piston is operated, or shifted, during the rotation of the wheel, by means of a cam on its outside, which cam is a semi-circle, with the ends running out from the circle to catch a pin on the piston, and thus shift it.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the peculiar form and construction of the double piston moving over the shaft, in combination with the semi-circular cam outside the steam chamber, as described, for changing the position of the pistons as the wheel revolves."

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15. For an improvement in the *Lamp for burning Oil and Camphine;* Christian and Charles Richman, Philadelphia, Pennsylvania, June 11.

The wick tube of this lamp, which is on the principle of the Argand, is provided with two holders that are jointed to the lower end of the tube, their upper ends being semi-circular, and made to hold the wick against the upper end of said tube. This holder slides on the inner cylinder of the lamp, a pin on its inner side passing into a groove on the outside of the cylinder; and on the outside of the holder is placed the runner, which has a spiral groove running from its upper end to near the bottom, into which fits a pin from the wick holder, so that by turning the runner the wick holder will be made to rise or sink vertically. The upper end of the runner is connected with the glass holder. The button is made conical and of glass, instead of being flat and of metal.

Claim.—"What we claim as our invention, and desire to secure by letters patent, is the manner in which we have combined the wick tube with the runner and internal cylinder, which is to say, we claim constructing the runner with a spiral, as set forth, in combination with the internal cylinder having a vertical groove and the wick tube arranged between them, by the combined action of which revolving spiral and stationary groove, the wick tube and wick are raised without being turned, as in the ordinary astral lamps. We also claim the manner in which we have combined the clasps with the wick tube, by forming it into two parts, and connecting them by hinges to the bottom of the tube, as set forth. Lastly, we claim the employment of a conical glass button in lamps for burning camphine and other oils."

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16. For an improved *Apparatus for, and mode of, Feeding Silk Worms;* Edmund Morris, Burlington, New Jersey, June 16.

The feeding frames are made of strips of wood, arranged at proper distances apart in a frame, the two hind corners of which fit into grooves made in the sides of two uprights; about twelve inches above each frame is placed the roof, consisting of a frame with cords stretched across it, to sustain a layer of straw, and a cover, to catch the dirt which falls from the feeding frame, which stands three inches above it. In this manner the feeding frames and roofs are arranged one above the other. A fork is used, called a "cleaner," for the purpose of lifting the material on which the worms have been feeding; this cleaner consists of a bar, provided with two handles, one near each end, and ten or more prongs.

Claim.—"I claim the manner of constructing the above described apparatus, or frame, for feeding silk worms—that is to say, I claim the combining together of a series of feeding frames and of roofs, by sliding the end pieces of the same, extended out for that purpose, into grooves made in uprights, which may extend from the floor to the ceiling of the room; said feeding frames and roofs having such uprights at their backs only, and forming a continuous and unobstructed range in front of them, along the whole, or any desired portion, of the apartment, without the intervention of uprights, or supports of any kind, so as to admit of the operations of feeding and cleaning being carried on with perfect facility, the respective parts being arranged and combined substantially as set forth. I claim the method of cleaning the worms, when necessary, by the employment of the cleaning fork described, by which I lift at once the entire surface on which the worms may be feeding, so as to clean them without waiting, as the practice has been, for the worms themselves to mount up into fresh foliage, and so as to allow the mass, stems, and foliage, to be promptly removed. I claim the within described manner of forming the portable straw spinning roof, in which the worms are to form their cocoons, and by the portability of which I am enabled to identify the age, from the spinning, of any number of cocoons, the gathering of which is thereby greatly facilitated, while their value is not endan-

gered by being kept too long ungathered; the said spinning roof serving the double purpose of catching the litter from above as it falls from the frame, and of affording a suitable place for the worms to spin in as they rise from the frame below."

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17. For an improvement in the *Spark Arrester*, for the Chimnies of Locomotives, and other Steam Engines; Richard French, Philadelphia, Pennsylvania, June 16.

The chimney is surmounted by a concave cap, placed a short distance above its upper end, sufficient room being left for the draught. The whole is surrounded by an outer casing, which forms a receptacle for the sparks which are thrown down by the cap. The top of this outer casing is formed of perforated concentric sheets, or hoops, of metal, arranged as expressed in the claim, which is in the following words, viz:

"What I claim, and desire to secure by letters patent, is the manner described of arranging and combining the hoops, or bands, of perforated sheet metal, or of wire gauze, by uniting them at their upper and lower edges, alternately, so as to produce continuous perforated surfaces of great extent; between which surfaces concentric circular spaces are left when the instrument is made circular, as is usually done. I also claim the combining with the foregoing apparatus of perforated hoops, bands, or plates, a disk, or cap, interposed between the top of the chimney and said system of perforated hoops, or bands, for the purpose made known."

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18. For improvements in the *Plough;* David Prouty and John Mears Boston, Massachusetts, June 16.

These improvements are for a mode of uniting a double reversible point, or nose, with the share, or wing, and the two with the mould-board, in the manner expressed in the claim, which follows, viz:

Claim.—"First, we claim arranging, or connecting, the invertible nose and ring together, by means of suitable grooves on the side of the former, and the corresponding angular, or wedge-shaped, sides of the latter, fitting into the grooves as described; and we also claim imbedding the invertible wing and nose, or point, upon the mould-board, and confining them in their positions by means of a cap, having projections and grooves corresponding with those of the said invertible parts; the cap being rebated to the plough share, so as to have its upper face a continuation of the curved surface of the same; the whole being confined together by a bolt, or bolts, and nuts, as described."

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19. For an improvement in the *Grates of Cotton Gins;* Albert Washburn, Bridgewater, Plymouth county, Massachusetts, June 16.

This improvement is intended to obviate the necessity of renewing the grates of cotton gins in consequence of the wear which takes

place at the part where the saw teeth pass, by making a dovetail groove to receive a piece of metal, glass, or hard wood, which may be taken out when worn, and renewed without the necessity of even moving the grate.

The claim is confined to this manner of construction.

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20. For an improvement in the machine for *Trimming Books, Cutting Paper, &c.;* Frederick J. Austin, New York city, June 16.

The books, or paper, to be cut or trimmed, are secured in a press of the usual construction; and the knife by which the cutting is effected receives a double motion, which causes it to give a drawing cut, thereby cutting more smoothly and easily than if the cut were directly vertical. The knife is attached to a frame, which is provided with what the patentee calls "inclines, or cams," which slide against similar cams attached to the frame of the machine. This knife frame is connected by means of two jointed connecting rods, with a vertical sliding frame at the bottom, that receives motion from two pinions on an arbor, the teeth of which take into the teeth of two racks attached to the frame. As the lower sliding frame moves down, it draws with it the knife frame, which at the same time receives a lateral movement by the inclined ways, or cams, at the side.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the peculiar mechanical combination used to give a lateral, or sliding, motion to the knife, which consists of the inclines, or cams, formed on the knife frame working on the cams attached to the frame of the machine, the connecting rods, and the lower sliding frame, for the purpose, and in the manner, specified. Also, I claim the mechanical construction of the press, as arranged and combined with the parts for cutting, thereby forming an entire machine for the purpose described."

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21. For an improvement on his *Self-acting Log Brace for Saw Mills;* Benjamin Cushwa, Clear Spring, Washington county, Maryland, June 19.

This improvement is added to a patent granted to Mr. Cushwa on the 15th of July, 1840, and noticed in this Journal, vol ii, 3rd series, page 203.

The improvement claimed is, for the addition of a ferrule with a flanch on to the roller of the log brace, which supports the log, as previously patented; which ferrule and flanch may slide on the said roller, and be set nearer to, or farther from, the line of the saw. The object of this improvement is to prevent the springing of the log—an effect which generally takes place after a slab has been cut from it.

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22. For an improvement in the process of *Burning Lime;* Samuel Garber and Henry Swartzengrover, borough of Norristown, Montgomery county, Pennsylvania, June 19.

The improvement above referred to, is added to a patent granted

to the same persons, on the 25th of March, 1837, and is fully explained in the following claim, viz:—"We claim as our improvement in the calcination, or burning, of lime, the introduction of heated air into a lime kiln, for the purpose of burning or calcining the lime contained therein; and this we claim by whatever means the air may be heated, and whether the lime is or is not intermingled with fuel in the kiln."

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23. For an improvement in the *Slides of Extension Tables;* Charles F. Hobe, city of New York, June 22.

The slides in these improved extension tables are to be plated with metal, and arranged in such manner as to give a longer bearing than is attained by means of the common dovetail slides. Each side of a slide is grooved for about two-thirds its length, the groove commencing on the two sides at opposite ends. These grooves are covered with plates, having slots in them, running nearly the whole length. On each side of the slide, and at that end of it which is not occupied by the slots, there is a T shaped piece of metal, which slides in the slot of the adjoining slides. The slots are enlarged at one end, to admit the T shaped piece, and this enlargement is then closed by a piece of metal which is held by a screw. By this arrangement, each side of each slide is connected with the adjoining slide, in two places, its T piece on one end, fitting into the slot of an adjusting slide, and a slot on the other end receiving the T piece from the adjoining slide; the same connexion being repeated on each adjoining slide.

The claim to the foregoing arrangement refers throughout to the drawings.

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24. For a new *Composition for Coating Metals, to prevent Corrosion;* Arthur Wall, Shadwell, England, June 22.

(See Specification.)

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25. For improvements in the *Washing Machine;* H. R. Walter, Norwich, Chenango county, New York, June 22.

In this washing machine "the clothes to be washed are placed upon a fluted board, which lies horizontally within a trough, or cistern, containing the suds, or water, by which the cleansing is to be effected. Over this board, and upon the clothes laid upon it, a fluted roller is to be passed back and forth, which roller revolves in suitable head-blocks, and is pressed down by the action of spiral springs, so as to enable it to yield to the inequality of thickness in the articles to be washed. The roller is surmounted on its upper side by a plate of sheet metal, which extends from one head-block to the other, and with them constitutes a frame for containing the fluted roller. This fluted roller frame is held down, as it traverses back and forth, by guide pieces attached to the sides of the cistern, and which enter into grooves made on each end of the frame to receive them."

Claim.—"What I claim is the manner in which I have constructed the fluted roller frame, and combined the same with the trough, or

cistern, as herein set forth; that is to say, I claim the arranging of the fluted roller so that its gudgeons shall be received in sliding rods, which are acted upon by spiral springs contained in two head-blocks, are connected together by a cap, or covering, which incloses the fluted roller; the whole being constructed substantially in the manner described. I claim, also, the combining of the said fluted roller frame with the cistern, by means of ledges attached to said cistern, and received within grooves on the head-blocks, said grooves being furnished with friction rollers on their lower sides, and the roller frame being made to work back and forth horizontally, upon a horizontal wash board, for the purpose, and in the manner, described."

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26. For an improvement in the *Water Wheel* for Mills; Nelson Johnson, Triangle, Broome county, New York, June 22.

The patentee calls this an "improved direct percussion and reaction water wheel," that is to say, the wheel is to be actuated by the striking of the water upon the buckets, aided by the reaction as the water leaves them at the bottom. The outer rim of this wheel is conical, with a flanch curving outward at the lower edge, and the inner rim is in the form of the lower section of a bell. These two rims are connected together by curved buckets, the outer rim being scolloped, to correspond with the upper, inclined, curved surface of the buckets. The inner rim is lower than the outer, so that the buckets incline downwards, towards the shaft, as well as in the direction of the circumference.

"What I claim as my invention is the manner in which I have combined the buckets with the inner bell-shaped rim, and outer conical rim, by forming the scollops in the upper edge of said outer rim where the water enters, instead of in the lower edge of said rim, where it discharges, as in my original improvement; and combining one edge of the buckets with the scollops thus arranged, and the other with the inner bell-shaped rim, as set forth."

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27. For an improved mode of *Setting up Printing Types;* James Hadden Young, of England, and Adrain Delcambre, of France, June 22.

This invention consists in a machine, or apparatus, for what is technically called composing, or the setting up, of types for the purpose of printing; by its means the letters are to be placed in their proper order, as in the composing stick, in a much more rapid manner than heretofore; this is effected by means of an inclined plane, or inclined planes, upon which the types are thrown, and allowed to descend by various channels, which meet in one point, at the composing box, which supplies the place of the ordinary composing stick. There are a number of keys, somewhat similar to those of a piano forte, which act upon levers that push the types on to the inclined plane, or planes, down which they descend by their own gravity, to the said box, whenever the keys are depressed; such types being so pushed out of

boxes, or cases, made to contain them. The types are arranged in the composing box side by side, and then removed by hand to the chase, in the usual way.

There is a groove for each letter of the alphabet, the entrance to which is governed by what is called a pushing frame, in connexion with a key having a corresponding letter marked upon it. These grooves are all arranged side by side on the inclined plane, and are covered by a covering plate, to prevent the types from jumping out. The types are arranged in cases, consisting of inclined channels, and each channel is in connexion with an appropriate groove, and when the proper key is acted upon, the pushing frame forces the lowest letter out of the channel into the groove, down which it descends to an aperture, provided with a spout, which insures the proper delivery of the letter in the composing box; and at the reception of each letter, a combination of levers, acted upon by the keys, causes all the former letters to be pushed forward for the reception of the next.

Claim.—"We hereby declare the inclined plane, the pushing frame, the covering plate, our new composing box, and the movements connected with the said box, to constitute our said invention, for which we hereby claim to maintain exclusive right and privilege, by means of letters patent.

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28. For an improvement in the *Lamp for Burning Lard;* Edward T. Williams and Latham T. Tew, Newport, Rhode Island, June 26.

The body of the lamp, or stand, is cylindrical, and within it a piston is fitted, for the purpose of forcing the lard up to the wick. Two screws pass through the said piston, and extend down to the base of the lamp, and are each provided with a pinion, the teeth of which take into the teeth of a small cog wheel, which has an axle adapted to the reception of a key fitting into it from the under side of the base, or stand. Under this arrangement, the turning of the key will actuate the screws, and thus work the piston up or down.

The claim is to the method of feeding the lamp, or elevating the lard into the reservoir which contains the wick, by means of a movable piston in the tube, or neck, of the lamp, arranged and operated in the manner described.

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29. For an improvement in the *Spark Arrester* for Locomotive and other chimneys; Leonard Phleger, Philadelphia, Pennsylvania, Assignee of W. W. Hubbell, Moyamensing, Philadelphia county, Pennsylvania, June 26.

In this apparatus, the spark arrester and the receptacle for the sparks, instead of surrounding the chimney as usual, is placed alongside of it, and they are made to communicate with each other at, or near, the top—the latter being of greater diameter than the former. Within the tube of the spark arrester there is a perforated tube of less diameter and length, so as to leave a space all around, between the

two, and at the bottom. The perforated tube, where the arrester receives the draught, smoke, sparks, &c., is covered with solid sheet metal, for the purpose of scattering the sparks. The top of the chimney is provided with a cap, which may be removed whenever it is not desired to make use of the arrester. The space between the outer and the inner perforated tube is covered, so that the draught must pass through the perforations in the inner tube, the sparks being retained in the space between the two.

By this arrangement, we are told by the patentee, that "the chimney is not rendered top-heavy, a less surface than usual is exposed to the action of the wind; advantage is also derived from the large surface of the casing which is exposed to the action of the external air, which condenses a portion of the exhaust steam which is passed into the chimney as usual, and is forced along with the sparks, into the space between the outer and inner tubes."

Claim.—"What I claim as constituting my invention, and desire to secure by letters patent, is the manner in which I have arranged and combined the chimney and the spark arrester and depositor; the chimney not being surrounded in any part by the arrester, but the two being placed side by side, and communicating with each other at their upper ends; and the arrester and depositor consisting of an outer case, an inner perforated, or wire gauze, cylinder, or tube, with an imperforated part where the draught first strikes it; and having a receptacle for cinders and ashes at its lower end, as described."

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30. For an improvement in the *Spark Arrester* for Locomotive and other chimneys; Leonard Phleger, Philadelphia, Pennsylvania, Assignee of W. W. Hubbell, Moyamensing, Philadelphia county, Pennsylvania, June 26.

The chimney, in this arrester, is surrounded by a perforated cylinder, and the whole by a jacket, which extends down lower than the said perforated cylinder, but not quite so low as the chimney. The chimney is provided with a movable cap, as described in the preceding notice; and the space between the perforated cylinder and jacket is permanently covered with a cap. Near the top, the chimney communicates with the outer space, by means of pipes that pass through the perforated cylinder, so that the draught passes from the chimney into the outer space, and thence, through the perforations in the cylinder, into the space between the chimney and perforated cylinder, and out at the top.

Claim.—"I hereby declare that I do not claim to be the first inventor of either of the separate parts thereof individully, but I do claim to have so combined and arranged these parts as to have produced an instrument substantially new in its character, and beneficial in its effects; that is to say, I claim the surrounding of the chimney by the perforated metallic cylinder, or cone, and the jacket, or case, combining these parts together, and inclosing them in the manner set forth; the chimney being furnished with a cover, or shutter, and tubes, or pipes, of communication extending from said chimney into the outer

space; and the other parts concerned in the action of the apparatus, being arranged substantially in the manner, and so as to produce the results, set forth."

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31. For an improvement in the *Spark Arrester*, or Depositor; Leonard Phleger, Philadelphia, Pennsylvania, Assignee of W. W. Hubbell, Moyamensing, Philadelphia, Pennsylvania, June 26.

In this instrument, the smoke box is surmounted by a drum, and upon this is placed the chimney, which is connected with it by means of a hinge, to admit of passing under bridges, &c. Within the drum is placed a cylinder of perforated metal, or wire gauze, which is closed at its lower end by a plate of solid metal, with a hole in the middle, surrounded by a flanch projecting downwards, for the reception of the exhaust steam pipes, the upper end of the said cylinder being left open. Within the drum there is a belt, or zone, of perforated metal, or wire gauze, united with it at its lower end, and which extends up conically and is united with the upper end of the perforated cylinder, by an annular plate which closes the space between the two. In the space between the perforated cylinder and zone, there is an imperforated casing, or tube, which extends from within a short distance of their upper ends, to the top of the fire box, a part of it being within, and the rest below the drum, the lower end of which is inclined and connected with the said case by an annular plate, that forms an inclined plane, to cause the sparks which fall upon it to descend into a box at the side. There is an inclined pipe which runs down from the inclined lower end of the drum to the box or receptacle for the sparks; this pipe is divided into two parts by a perforated diaphragm, extending its length, and dividing it into an upper and lower space; the upper space being connected with the upper part of the drum by a pipe. Within the perforated cylinder is an imperforated tube, open at both ends, (and supported by stays,) for the purpose of directing the exhaust steam immediately up the chimney, and to prevent it, by its expansion, from impeding the passage of the draught through the perforations in the cylinder.

Claim.—"What I claim as new, and desire to secure by letters patent, is the particular manner in which I have combined and arranged the respective parts, as set forth; that is to say, I claim, in combination, the perforated cylinder, and the perforated belt, or zone, connected with each other by means of an imperforated annular plate, the lower edge of the zone being connected to the drum, as described and represented. I also claim, in combination with each other, the arranging of the inclined annular plate of metal, the tube leading to the box, the perforated diaphragm, and the tube, so as to conduct and deposit the sparks in the box, whilst that portion of the draught which accompanied them and forced them down, is allowed to escape into the chimney, as described."

32. For a *Horizontal Spark Arrester* for Locomotive and other chimneys; Leonard Phleger, Philadelphia, Assignee of W. W. Hubbell, Moyamensing, Philadelphia county, Pennsylvania, June 26.

The patentee says:—"I have combined a horizontal spark arrester and flue with a vertical chimney, which chimney may, in most cases, be made so short as not to require to be turned down, but which may, if desired, be attached to the part constituting the arrester by a hinged joint, and may then be turned down with facility. The horizontal flue that is combined with the spark arrester may be considered as constituting a part thereof, and it is likewise to be considered as forming a part of the chimney; this horizontal flue I sometimes surround by the perforated sheet metal, or wire gauze, by which the sparks are to be arrested."

Claim.—"What I claim, and desire to secure by letters patent, is the combining of a spark arrester, placed in a horizontal position, with a vertical chimney, substantially in the manner set forth, for the purpose of obtaining the necessary length of flue, and of perforated metallic surface for the proper action of the instrument, whilst the vertical chimney itself may be so short as to pass under the lowest bridges upon railroads."

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33. For *Railroad Alarm Signals;* Samuel Nicolson, Boston, Massachusetts, June 26.

There is a curved lever jointed to the track, (the curved surface projecting above the rail,) and connected by bell cranks and wires passing under the track, to an alarm bell elevated to a considerable height, and worked by a weight, in the usual manner. When the wheels of the tender pass over the curved lever, it is pressed down, which communicates with, and starts, the alarm.

Claim.—"I claim as my invention, and desire to secure by letters patent, the method of communicating motion to the alarm, by the passing of the wheels of the tender, &c., over the curved lever connected with the alarm, in the manner specified."

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34. For an improvement in *Casting Composition Screws;* John Luther, Warren, Bristol county, Rhode Island, June 26.

This patent is for making screws with the head and shank of brass, iron, or other hard metal, and for casting thereon a body and threads of soft metal or composition. Into a mould of the form of the intended screw, the soft metal, or composition, is poured, and the hard metal shank, which must be previously tinned, is then inserted, thus causing the soft metal, or alloy, to adhere to the tinned surface of the shank.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is making cast screws with iron, brass, or copper heads and shanks, whilst the body and thread are made of tin, lead, zinc, antimony, or any soft metal, or any of these combined."

35. For an improvement in the *Machine for Hulling Rice*, and any other kind of Grain; Webster Herrick, Northampton, Hampshire county, Massachusetts, June 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the employment of two disks, covered with pointed wires, or with stout card teeth, one of which disks is made to revolve vertically within a drum, and is borne up against a stationary disk, similarly armed, by means of a spiral spring pressing against its shaft, and regulated by a tempering screw; and having combined therewith an iron centre plate, or disk, provided with projecting ribs," (for the purpose of throwing the grain towards the wire rubbers,) "in the manner described."

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36. For an improvement in the manner of *Constructing Wheels for Rail and other Roads;* Henry Dircks, Liverpool, England, June 26.

This wheel is formed with a groove, or channel, into which is filted blocks of wood, with the grain running radially, and bolted to the iron, as a substitute for the iron tread.

Claim.—"I claim the combination of a metallic wheel with a wooden faced tire, or tread, as before described, without being confined to its precise mode of construction, or putting together."

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37. For an improvement in the *Floating Dry Dock*, for raising vessels; John Thomas, New York, June 26.

This improved floating dry dock is of the kind which is made in sections, with floats at each end, for the purpose of assisting the main float in raising the vessel, and to prevent the whole from rocking. Each section consists of a truss frame, on which the vessel rests, and at each end it is provided with a large float, which is made to slide up and down in a frame, by means of screws with double right and left handed threads, which act upon nuts in two sets of followers. There are tongue pieces with key holes along their length, attached to the floats, which pass through mortises in the followers. The turning of the screws causes the followers to approach towards, or to recede from, each other, simultaneously. The advantage of this device is, that as one follower is lifting up, or forcing down, the float, by having the tongue piece keyed to it, the other is returning to the proper place for commencing action when it shall have reached the limit of its play, instead of using but one follower, which requires the operation to be arrested whilst it is returned to its place, or else em ploying a screw of the whole length of the play of the float.

"I am aware that end floats have been used in floating dry docks for the double purpose of preserving the equilibrium of the dock, and to assist the main floats in the body of the dock, in raising the vessel and frame; the main floats being sunk by admitting water into them, and then by pumping it out, and therefore I do not claim merely the use of end floats, or dispensing with the inner, or main, floats, as

made known, and used; but what I do claim as my invention, and desire to secure by letters patent, is the employment of movable end floats of sufficient capacity to raise the vessel, or vessels, and dock, by forcing them down by mechanical force, when used without the the inner, or main, floats employed heretofore, for the purpose, and in manner described. I also claim the combination of the right and left handed screws, followers, tongue pieces, and movable floats, for the purpose, and in the manner, described."

Specifications of American Patents.

Specification of a patent granted to Arthur Wall, *of Shadwell, Great Britain, for a composition for preventing Corrosion in Metals, June 22d,* 1841.

Be it known that I, Arthur Wall, of Shadwell, in the county of Middlesex, in that part of the kingdom of Great Britain called England, surgeon, have invented a new composition for the prevention of corrosion in metals; and I do hereby declare that the following is a full and exact description of it. To enable others skilled in the art to use my invention, I will proceed to describe the mode of manufacturing the same, and the application thereof. I place twenty pounds of the strongest muriatic acid, diluted with three gallons of water, in a shallow pan, or vessel, made of cast iron. I then take 112 pounds of filings of either steel or bar iron, or other wrought iron; I heat them to redness and throw them into the mixture of acid and water, for the purpose of oxidizing the filings. I then place the pan on a sand bath, (heated by a flue from a furnace,) which digests the filings, and facilitates the oxidation. I repeatedly stir up the whole, and after subjecting them to this process for about twenty-four hours, or until ebullition takes place, and the greater part of the filings are taken up by the liquor, or mixture, I allow the oxides thus obtained, to run off through a tap into a vessel beneath, leaving the metal not operated upon at the bottom. When these oxides are quite settled, the clear mixture, or liquor, is run off from them into a third vessel, and then the filings must be subjected to the same process in the original mixture, to complete the oxidation, (that is,) they must be again made red hot, and the mixture which has run into the third vessel thrown upon them, and this process must be repeated until all the filings have oxidized that can be made to do so. The oxides thus obtained I now expose on an iron plate, made red hot over a furnace, until all moisture has evaporated from them, and they assume a red appearance. I then mix with them sixteen pounds of quicksilver, by sifting it through a very fine wire sieve on to the oxides, and afterwards I intimately mix it with them by rubbing the whole down in a mortar, or other suitable process, and when so mixed I then add as much water as will cover the surface, and from eight to nine pounds of strong nitric, or nitrous, acid, and again place the whole on the furnace plate, or iron bath, and repeatedly stir it until all the

menstruum, or liquor, has nearly, or completely, evaporated. I then place the whole mass in a mortar, or other pounding machine, and bray, or pound, it until it is in a complete state of blackness. I then mix it with water, and stir, or wash, it until all the light particles are washed out. I then allow it to settle, and when the settlement has taken place, the water is poured off from the sediment at the bottom. This sediment I then place in a crucible, or earthen retort, with a receiver attached, adapted for the reception of any chloride, or mercury, that may escape, or come over, (the contents of this receiver I preserve, in order to re-add to the general mass afterwards, when cool;) then I make it red hot, and when in this state I plunge it into fresh boiling water, and stir it for a few minutes, and then allow it to settle. I then pour the water off, let it cool, and add the chloride, as before stated; and after the last mentioned process, I add to it one-quarter of its own weight of common black lead, or minium, commonly called "red lead," according to the color which the operator wishes the composition to assume. Previously to applying this composition to metal, I add to it such a quantity of boiled linseed oil and spirit of turpentine, (in the proportion of one-fifth of spirit of turpentine to the oil used,) as will reduce it to a state sufficiently liquid to be spread with a brush. This preparation I then apply as thinly as possible, by means of a brush, to sheets of copper, or other metal; which sheets I afterwards subject to a heat gradually raised to about 300 degrees of Fahrenheit's thermometer, so as to make the metal imbibe the preparation; this heat must be applied to the sheets of prepared metal, without smoke or flame, by placing the sheets on trucks in contact with the flue plates, in the manner hereinafter described. The mode of applying this heat may be various, but in order the more distinctly to explain my meaning, and likewise my mode of operating, I shall now proceed to describe the furnace which I use, and find to answer the purpose. I erect two or more horizontal flues, the construction and dimensions of which may be varied according to circumstances, which flues should gradually decline towards the extreme end from the furnace bars, so as to produce a good draught and communicate a stronger heat to the plates above next mentioned. These flues I cover with cast iron plates. I then raise the exterior walls of the furnace to the height of from about three to six feet above the iron plates, which walls must be bound with iron braces to prevent them from cracking, from the excessive heat. I then place thin sheets of iron slightly curved, thus forming a roof, and rest them on the exterior wall. Each end of the chamber (thus formed) is closed by an iron plate, made to slide up and down by a pulley, so as to act as a damper, and let out, or confine, the heat. The heat from the flues is carried away by a common chimney, which has a damper in it for the purpose of controlling the heat. The sheets of metal prepared with the composition as above described, are thus placed upon iron trucks, between upright pins which run on wheels of four inches in diameter, and are thus placed over the iron plates made hot by the flues; the heat must be gradually applied to prevent the composition from blistering on the metal, by the trucks being first

placed at the extreme end from the furnace bars, and gradually rolled over the flue till evaporation ceases, and the metal assumes a dark appearance—this completes the operation. When preparing iron tanks with the composition, I apply the furnace heat merely sufficient at first to expel the moisture from the metal, and when in that state I take them out and sprinkle over them as much charcoal, very finely pounded, as will be absorbed by the metal, which gives to the metal, when prepared, a glossy appearance. I then apply the stronger heat, and the operation is completed.

Now, I do not claim as any part of my said invention any of the separate processes, or the use of any vessels or furnaces. But what I do claim as my invention, and desire to secure by letters patent, is the composition prepared as above described, for the prevention of corrosion in metal and for other purposes.

Crane's Anthracite Iron.

Decision of the Court of Common Pleas, affirming the validity of the Patent granted to George Crane, Esq., for Smelting Iron with Anthracite Coal. Delivered at Westminster Hall, June 13th, 1842, by Lord Chief Justice Tindall.

The Lord Chief Justice:—This was an action on the case for the infringement of a patent granted to the plaintiff on the 28th of September, 1836, for an improvement in the manufacture of iron. The declaration was in the usual form, and the defendants pleaded thereto, first, that they were not guilty; secondly, that the plaintiff was not the first and true inventor of the said improvement—upon each of which pleas issue was joined;—thirdly, after setting out at length the plaintiff's specification, the defendants pleaded that the alleged improvement therein described, was not a new manufacture, invented by the plaintiff within the intent and meaning of the statute, as to the public use and exercise thereof in England—which allegation was traversed by the plaintiff in his replication; fourthly, the defendant pleaded that the nature of the plaintiff's invention, and the manner in which it was to be performed, were not particularly described, or ascertained by the plaintiff, in his specification—upon which plea issue was joined; and in their last plea, the defendants, after referring to the plaintiff's specification, before set out in the third plea, stated the grant of letters patent, dated September 11, 1828, to one James Beaumont Neilson, for an improved application of air to produce heat in fires, forges, and furnaces, where bellows and other blowing apparatus were required—that Neilson's invention was the production and application of a hot-air blast, and was in public use with Neilson's license in the smelting and manufacturing of iron from iron-stone, and was the hot-air blast in the plaintiff's specification mentioned—that the plaintiff could not use the hot-air blast mentioned in his specification without Neilson's license, and that he had obtained such license before the grant of his letters patent, and that the using, by the plaintiff, of the hot-air blast, in the smelting of iron from iron-stone,

combined with anthracite or stone-coal, as mentioned in his specification, was a using and imitating of Neilson's invention, whereby the plaintiff's invention was void. The plaintiff replied to this last plea, that Neilson's invention was not the same hot-air blast, and that the machinery and apparatus adapted for the application thereof, mentioned and referred to in the plaintiff's specification, was not, nor was the using by the plaintiff of the invention, as described in his specification, a using and imitating of Neilson's invention, described in Neilson's specification; which allegation is traversed by the defendants in their rejoinder. At the trial before me, a verdict was entered for the plaintiff on all the issues, subject to the opinion of the Court, upon the evidence given at the trial, as contained in a report agreed upon between the parties—the Court being at liberty to draw the same inference from it as a jury might draw. On the argument, it was contended by the defendants, that the verdict ought to be entered for them on each of the issues joined on the record; but as the main question between the parties turns on the third issue, which involves the question whether the invention of the plaintiff is a manufacture within the intent and meaning of the statute of James—that is, whether it is or is not the subject matter of a patent—and as the determination of this issue, in favor of one party or the other, will render the decision of the other issues free from difficulty, the simplest way will be to apply ourselves in the first instance to that question. Now, in order to determine whether the improvement described in the patent is, or is not, a manufacture within the statute, we must, in the first place, ascertain precisely what is the invention claimed by the plaintiff, and then, by the application of some principles admitted and acknowledged in the application of the law relating to patents, and by the authority of decided cases, determine the question in dispute between the parties. The plaintiff describes the object of his invention to be the application of anthracite or stone coal, combined with hot-air blast, in the smelting or manufacture of iron from iron-stone, mine, or ore; and states, distinctly and unequivocally, at the end of his specification, that he does not claim the use of a hot-air blast, separately, as of his invention, when uncombined with the application of anthracite or stone-coal; nor does he claim the application of anthracite or stone-coal, when uncombined with the using of hot-air blast; but that what he claims as his invention, is the application of anthracite or stone-coal, and culm, combined with the using of hot-air blast, in the smelting and manufacture of iron from iron-stone, mine, or ore. And the question, therefore, becomes this—whether, admitting the using of the hot-air blast to have been known before in the manufacture of iron with bituminous coal, and the use of anthracite and stone-coal to have been known before in the manufacture of iron with cold-blast; but that the combination of the two together (the hot-blast and the anthracite) were not known to be combined before in the manufacture of iron, whether such combination can be the subject of a patent? We are of opinion that if the result produced by such a combination, is either a new article, or a better article, or a cheaper article to the public than that produced before by the old method, that such combi-

nation is an invention, or manufacture, intended by the statute, and may well become the subject of a patent. Such an assumed state of facts falls clearly within the principle exemplified by Abbot, Chief Justice, in the case of the King *v.* Wheeler, 2d Barnewall and Adolphus 349, where he is determining what is, or what is not, the subject of a patent—namely, it may perhaps extend to a new process, to be carried on by known implements, or elements, acting upon known substances, and ultimately producing some other known substance, but producing it in a cheaper or more expeditious manner, or a better or more useful kind. And it falls, also, within the doctrine laid down by Lord Eldon, in Hill *v.* Thompson, in 3d Merivale 629—namely, there may be a valid patent for a known combination of materials previously in use, for the same purpose, or even for a new method of applying such materials; but the specification must clearly express that it is in respect of such new combination or application. There are numerous instances of patents which have been granted, where the invention consisted in no more than in the use of things already known, and acting with them in a manner already known, and producing effects already known; but producing those effects so as to be more economically or beneficially enjoyed by the public. It will be sufficient to refer to a few instances, some of which patents have failed on other grounds, but none on the ground that the invention itself was not the subject of a patent. We may first instance Hall's patent for applying the flame of gas to singe off the superfluous fibres of lace, where a flame of oil had been used before for the same purpose; Derosne's patent, in which the invention consisted in filtering the syrup of sugar through a filter, to act with animal charcoal, and charcoal from bituminous schistus, where charcoal had been used before in the filtering of almost every other liquor, except the syrup of sugar; Hill's patent, in 3d Merivale above referred to, for improvements in the smelting and working of iron; there the invention consisted only in the use and application of the slags, or cinders, thrown off by the operation of smelting, which had been previously considered useless, for the production of good and serviceable metal, by the admixture of mine rubbish. Again, Daniel's patent was taken out for improvements in dressing woolen cloth, where the invention consisted in immersing a roll of cloth, manufactured in the usual manner, in hot water. (See the King *v.* Daniel, in Mr. Godson's book on patents, 274.) The only question, therefore, that ought to be considered on the evidence, is—was the iron produced by the combination of the hot-blast and the anthracite, a better or a cheaper article than was produced from the combination of the hot-blast and the bituminous coal; and was the combination described in the specification new, as to the public use thereof, in England? And upon the first point, upon looking at the evidence in the cause, we think there is no doubt that the result of the combination of the hot-blast with the anthracite, on the yield of the furnaces, was more; the nature, properties, and quality of the iron, better; and the expense of making the iron less, than it was under the former process, by means of the combination of the hot-blast with the bituminous coal. It is to be ob-

served, that no evidence was produced on the part of the defendants, to meet that given by the plaintiff on these grounds, and that it was a necessary consequence, from the proof in the cause, that the substitution of the anthracite coal, in whole, or in part, instead of, or in the place of, bituminous coal, from the substitution of that, the manufacture of the iron should be obtained at less expense. It was objected, in the course of the argument, that the quality, or degree, of invention, was so small, that it could not become the subject-matter of a patent; that a person who could procure a license to use the hot-air blast under Neilson's patent, had a full right to apply that blast to coal of any nature whatever, whether bituminous or stone-coal. But we think, if it were necessary to consider the labor, pains, and expense, incurred by the plaintiff in bringing his discovery to perfection, that there is evidence in this cause that the expense was considerable, and the experiments numerous. But in point of law, the labor of thought, or experiments, and the expenditure of money, are not the essential grounds of consideration on which the question, whether the invention is or is not the subject-matter of a patent, ought to depend; for if the invention be new and useful to the public, it is not material whether it be the result of long experiments and profound research, or whether by some sudden and lucky thought, or mere accidental discovery. The case of Monopolies, 11th Coke, states the law to be, that where a man, by his own charge or industry, or by his own wit or invention, brings a new trade into the realm, or any engine tending to the furtherance of a trade, that never was used before, and that was for the good of the realm, that the King may grant him the monopoly of a patent for a reasonable time. If the combination now under consideration be, as we think it is, a manufacture within the statute of James the First, there was abundant evidence in the cause that it had been the great object and desideratum, before the granting of the patent, to smelt iron-stone, by the means of anthracite coal, and that it had never been done before. There is no evidence on the part of the defendants, to meet that which the plaintiff brought forward. These considerations, therefore, enable us to direct that the verdict ought to be entered for the plaintiff, on the third issue; that it was a new manufacture—new as to the public use and exercise thereof, within England and Wales. On the same ground, also, the second issue is disposed of in favor of the plaintiff. No evidence was produced, on the part of the defendants, to show any inventor earlier than the plaintiff; nor does the fact that there was an earlier inventor appear, from the cross-examination of the plaintiff's witnesses. As to the first issue—namely, whether the defendants had infringed the patent—we think it clearly appears on the evidence, that the defendants had used, either in part or in whole, the combination described in the specification of the plaintiff's patent; the plaintiff's evidence goes fully to show certain infringements, and that is not met by any explanation on the part of the defendants. Indeed, the defendants' case did not appear to rest on this point, at the trial, so much as on the important question raised by them, whether the improvement described in the specification was a manufacture within the statute of James.

Upon the fourth issue, which raised no more than the usual inquiry —whether the nature of the invention was sufficiently described in the specification?—the usual evidence was given, that persons of competent skill and experience could, by following the direction, produce the manufacture described, with success; and this evidence was entirely unopposed. Upon this issue, also, the verdict ought to be entered for the plaintiff. With respect, however, to the issue raised in the rejoinder, in the plaintiff's replication to the fifth plea, we are of opinion, that taking the whole evidence brought forward by the plaintiff, it is impossible to perceive any substantial or real distinction between the hot-air blast, and the machinery and apparatus described in Neilson's specification, from that described, or referred to, in the plaintiff's; or to say that the using by the plaintiff of the invention described in his specification, was any other than a using and imitating of the invention described in Neilson's specification. The plaintiff, indeed, worked by licence under Neilson's patent, at the time of his discovery. On this fifth issue, therefore, we think the verdict should be entered for the defendants. Then arises the question, whether the plaintiff is or is not entitled to the judgment, notwithstanding the verdict on the fifth issue, on which point the argument on the part of the defendants is, that the taking out a patent for an invention, which invention cannot be used or enjoyed by the public, except by means of the former invention of another person, which former invention is itself the subject-matter of a patent still in force, is void by law. Undoubtedly, if the second patent claims, as part of the invention described in it, that which had been the subject-matter of a patent then in force, it would be void, on the double ground that it claimed that which was not new, (which, indeed, would equally be the case if the former patent had expired;) and also that it would be an infringement of, and inconsistent with, a former grant of the King, still in force; which latter consideration, alone, would make a new grant void. But in this case, there is an express disclaimer of any part of the invention to the use of the hot-air blast, which was covered by Neilson's patent, the specification describing that the application of the hot-air blast was well understood, and extensively applied, in many places where ordinary fuel is employed. The validity, therefore, of the plaintiff's patent cannot be impeached on either of the grounds above adverted to. Unless, therefore, the grantee of the new letters patent is bound by law to specify whether such former invention which is excepted, was so excepted on the ground of its being generally known and used by the public, and on the ground that it was the subject of a patent, that secured the use of it to a former patentee, the new patent will be good; but that distinction is as much in the knowledge of the public as the grantee of the patent. If, indeed, the new patent had been taken out for improvement, or alterations, in an invention secured by a former patent, then, for obvious reasons, greater particularity would be necessary to distinguish the new from the old. But the present specification expressly says—"I take the whole of the invention, already well known to the public, and I combine it with something else." Now, it is fur-

ther argued, that in point of law no patent can be taken out which includes the subject-matter of a patent still remaining, or in force. No authority was cited to support this proposition; and the case which was before Lord Tenderden, and in which he held that where an action was brought for improvements in a former patent granted to another person, and still in force, that the plaintiff must produce the former patent and specification; *that* at least affords a strong inference that the second patent was good. *Lewis* v *Davis*, 3d Carrington, and *Payne* and *Harmer* v. *Payne*, 11th East., are clear authorities on the same point; and upon reason and principle there appears to be no objection. The new patent, after the expiration of the old one, will be free from every objection; and whilst the former exists, the new patent can be legally used by the public, by procuring a license from Neilson, or by purchasing the apparatus from him or some of his agents; and the probability of the refusal of a license, to any one applying for it, is so extremely remote, that it cannot enter into consideration as a ground of legal objection. On the whole, therefore, we think the verdict is to be entered for the plaintiff, on all the issues except the fifth; that the verdict is to be entered for the defendants on the fifth issue—but that, notwithstanding such verdict, the judgment must be given for the plaintiff.

Mr. M. Smith:—My Lord, there are certain certificates which were to be given, in case the judgment was for the plaintiff.

The Lord Chief Justice:—You must apply to me for those; that is not a matter for the Court—that is a matter for myself.

Cambrian.

Specifications of English Patents.

Specification of the Patent granted to Henry Browne, *of Codnor Park Iron Works, in the County of Derby, Iron Manufacturer, for Improvements in the Manufacture of Steel. Sealed April* 22, 1841.

To all to whom these presents shall come, &c., &c. My invention relates to a mode of manufacturing steel from iron, by obtaining the iron in a fine granulated state, and then treating it with cementation with carbon, as hereafter described; and in order that my invention may be fully understood, and readily carried into effect, I will proceed to describe the means pursued by me. In working according to my invention, the crude, or pig, or refined metal, is to be treated as if about to be made into bar or malleable iron, by the purifying and decarbonizing process of puddling—that is, by stirring the melted mass in the furnace with iron tools, and exposing it to the action of the heated air, as usually practiced, until the metal becomes in a dry granulated state, all of which is well understood by puddlers; and in place of carrying on the process further in the puddling furnace, the iron, in the granulated state, is to be removed from the furnace, and when cold, a large proportion may be passed through sieves, the meshes

of which are about twenty in an inch, and the remainder may be crushed or ground, until the grains will pass through the same sieve, or the various sized grains may be separated by various sieves, differing in the size of the mesh according to the will of the operator; but I consider that the smaller the grains, the more advantageously will the process of manufacturing steel therefrom be carried on; and it is the converting of granulated iron, such as above described, into steel, by cementation with carbon, that constitutes my invention.

The granulated iron is next submitted to cementation, which I perform in the following manner:—I use an ordinary cementing, or converting, furnace, the nature of which is well known, and the cementing chests, or what are usually called pots, are about ten feet long, three feet wide, and three feet deep; but the dimensions may be varied. I prepare a number of frames of iron or wood—I prefer wood, and that which is called pine—an inch or two less in length and breadth, so that they will pass easily into the pots; the frame, made of wood, about a quarter of an inch thick, and one inch deep, and divided by wood partitions, at distances of about every ten or twelve inches. The carbon I prefer to use is wood charcoal, crushed and passed through a sieve, the meshes of which may be about one quarter of an inch square, though other carbon may be used. I place a quantity of the charcoal, to the extent of about half an inch in thickness, over the bottom of the pot; and this I cover with paper, or other suitable substance, on which I place one of the wood frames, and fill the compartments thereof with granulated iron, before described. On the surface of the granulated iron I place another covering of paper, and apply more charcoal, and press it into all the spaces between the frames and the sides of the pot; and I cover the paper evenly to the extent of half an inch; I then apply another thickness of paper, then another frame, which I fill with granulated iron, as before, and cover it with paper; then charcoal, then paper, and then another frame; and so on until the pot is full, having charcoal on the top to the extent of three or four inches deep; I then cover the whole close down with loam sand, or "swarf," from a cutler's grinding-mill, or other suitable substance, to exclude the air, tempered and spread over the top of the pot to the thickness of five or six inches. I now heat the furnace to a high heat, as is well understood by steel manufacturers, and let the pot and its contents remain at that heat for a sufficient time, which I find to be from thirty to sixty hours. The time and heat may be varied, according to the state of carbonization required. The pot and its contents are to remain until cool, and, when opened, the steel will be formed into cakes of the size of the compartments in the frames, and may be removed; the charcoal and paper may be brushed off. The steel thus produced is then broken into pieces, and melted in the usual manner, in crucibles. The high or low state of carbonization may be judged of by the color, which will vary from blue to purple, straw color, and gray; that which is blue having less carbon, and is less firmly united together; and that which is grey, and more united, is charged in a higher degree with carbon. The quantity and hardness of the steel may be varied by a judicious

selection of the cemented steel, so as to adapt it to the purposes to which it has to be applied.

Rep. Pat. Inv.

Specification of the Patent granted to JOHN BETHELL, *of Saint John's Hill, Wandsworth, in the county of Surry, for Improvements in Treating and Preparing certain Oils and Fatty Matters. Sealed March* 28, 1840.

To all to whom these presents shall come, &c., &c. The object of my invention, so far as relates to improvements in treating and preparing oils, is to render certain oils, viz: whale, elephant whale, Newfoundland whale, seal, rapeseed, teel, olive, palm, cocoa-nut, or any of the other common oils, more useful, either for lubricating machinery, or for the purpose of illumination, and which I effect, first, by separating, clarifying, or precipitating, a portion of the gelatinous albuminous, or other matters contained therein; and, secondly, (when such are required for burning in lamps, or for illumination,) by adding thereto a portion of hydrocarbon, or essential oils, hereinafter named; and as regards the treating and preparing of certain fatty matters, the object of my invention is the manner in which I have hereinafter described, from butter of palm, cocoa-nut oil, or any other vegetable concrete oil, an oil which is more useful for mixing my purified oils, and which process also improves the fatty matter, or concrete oil, so operated upon, and which improvements I propose to carry into effect, in manner hereinafter described; that is to say—as to that part of the invention which relates to oils:—

First Process.—I take any or either of the common oils above named, and I purify them from the gelatinous albuminous and other matters contained therein, by first thoroughly well mixing the oil with a solution of tannin, which may be obtained from any of the vegetable matters yielding it; but I prefer using a strong infusion of gall-nuts in hot water, of which I take ten gallons, and thoroughly mix it with 100 gallons of oil, in any convenient manner. This mixture must afterwards be allowed to rest for three or four days, until all the tannin infusion, and precipitated matter, has settled down to the bottom. The clear supernatant oil is then drawn off, and again agitated and mixed with a solution of either acetate of lead, acetate of alumine, or sulphate of zinc, which I prefer using in the following proportions—viz: 1 lb. of acetate of lead dissolved in 6 gallons of water, or 1 lb. of acetate of alumine dissolved in 4 gallons of water, or 1 lb. of sulphate of zinc dissolved in 6 gallons of water; and I mix 10 gallons of either of such solutions with 100 gallons of oil; but I do not confine myself to these proportions, as solutions of different strengths can be advantageously used for different oils. The oil, after three or four days' rest, is drawn off from the top, and, if not sufficiently clear, must be filtered through oil-bags, in the usual manner. During the period that the oil is undergoing the above operations, I prefer that it be kept at a temperature as near 17° Fahrenheit as pos-

sible. Should the oil be afterwards found to contain too much water, I cause it to be agitated with about 10 per cent. of fresh calcined sulphate of lime, in fine powder, or well dried carbonate of soda, to abstract the greater part of the water from it. The sulphate of lime, or soda, must be allowed to precipitate by rest, or the oil must be filtered through bags.

Second Process.—I take the oil as purified by my first process, or I take the more fluid parts of cocoa-nut or palm-oil, and for the purpose of making a good burning lamp-oil, I add thereto from 5 to 10 per cent. of either of the following essential oils, or hydrocarbons—viz: petroleum, or rock-oil, Persian naphtha, fine oil of turpentine, or the best essential oil, obtained from the distillation of coal-tar, or the oil obtained, as hereinafter described, by distilling any of the above essential oils with palm or cocoa-nut oil; the quantity to be added depends on the kind of oil operated upon, and upon its strength, and will vary between 5 and 10 per cent., but will be easily ascertained by trying a small sample of the oil first. The essential oil, or hydrocarbon, must be intimately combined with the oil, either by thorough agitation together, or by passing the vapor of the essential oil, or hydrocarbon, into the oil, in an apparatus similar to a Wolfe's apparatus, but the former method I prefer for general use. In some cases, either from the oils operated upon being of a superior quality, or from so fine an article not being required, it is not necessary to use both the above processes, as either of them will be found sufficient for the purpose required. If a superior burning lamp-oil is required, I prefer using both of the above processes; but for a common lamp-oil, the oil may be prepared by either one of the above processes, without being submitted to the other, particularly when it is prepared by the second process only; and for a lubricating oil the first process only is used. As to the treating and preparing fatty matters, I take the "butter of palm," or "rough palm-oil," or rough "cocoa-nut oil," or any other concrete vegetable oil, and add to either of these, 20 per cent. of either of the essential oils above named. Put it into a common still, and distill off the essential oil, and the volatile matter which rises from the palm, or cocoa-nut, oil; but I prefer distilling with steam, and for that purpose I put the mixture into a close wood-vat, furnished with a steam pipe, leading from a steam boiler, and branching out into several other pipes, placed in the bottom of the vat, and pierced with small holes; the charging-hole of the vat being shut, steam is driven through the mass, and the volatile products are conducted, through a pipe fixed in the top of the vat, to a common distilling-worm, placed in cold water. The volatile oil so condensed, I mix with the oils for burning in lamps, as above mentioned, and the concrete fatty matter remaining in the vat is run out into casks, and will be found much improved, and more useful for many purposes.

In describing my improvements, I have stated the proportions of the different materials to be used, which I prefer; but I do not confine myself to such proportions, as they may be advantageously varied from different oils.

Ibid.

Specification of a Patent granted to ALEXANDER PARKES, *of Birmingham, Artist, for certain Improvements in the production of Works of Art, by Electric Deposition. September* 29, 1841.

These improvements consist in manufacturing articles in gold or silver by means of electric deposition upon suitable moulds, and in subsequently strengthening the articles so produced.

For this purpose, the patentee uses the following solutions of these metals:

Gold. An ounce of pure gold is dissolved in aqua regia, and evaporated to dryness, when 2 gallons of water, and 16 ounces of prussiate of potash, are added to it. This solution is used at a temperature of 120°, or 130°, of Fahr.

Silver. An ounce of pure silver, dissolved in nitric acid, is precipitated as oxide of silver, by lime water; the oxide being well washed, is mixed with 1 pound of prussiate of potash in 2 gallons of water.

The moulds used for this purpose are of metal, or other suitable material, in one or more parts, and may be removed from the finished article by melting or dissolving them.

The patentee prefers to use the compound, or independent, battery, from which the electric current is conveyed from the battery into a cell, or vessel, containing the metallic solution, and a plate of gold or silver, to be eroded by the electric action.

If the metal is to be precipitated on the interior of a mould, as in forming a bust, &c., the plate is placed within the mould; but if the metal is to be deposited on the external surface of the mould, the plate is placed on the outside thereof.

If the article produced requires greater strength than would be desirable to be given by the thickness of the precious metals, it may be strengthened by depositing copper within it, until the required substance is obtained; or the article may be filled with some fusible metal.

The claim is 1. To the mode of manufacturing articles in gold and silver, by depositions thereof, by electric agency, in or on suitable moulds or models, which may be removed from the articles of gold or silver, when the same have been formed. 2. To the mode of manufacturing articles of gold or silver, on or in metal moulds or models, which are deposited by electric means; such moulds, or models, being afterwards removed, as described. 3. To the mode of manufacturing articles of gold or silver, by electric deposition, on or in moulds or models, when such moulds or models are removed by heat or solution. 4. To the mode of manufacturing articles of gold or silver, by electric deposition, in or on moulds or models made up of parts. 5. To the mode of strengthening articles of gold or silver, produced in or on moulds, by electric depositions, by introducing a baser metal within them.

Mech. Mag.

METEOROLOGICAL OBSERVATIONS FOR APRIL, 1842.

Moon.	Days.	Therm. Sun Rise.	Therm. 2 P.M.	Baromtr. Sun Rise.	Baromtr. 2 P.M.	Wind. Direction.	Wind. Force.	Water Fallen in rain	State of the Weather, and Remarks.	
	1	28°	43°	30.20	30.30	NW.	Moderate		Clear.	Clear.
☽	2	40	66	30.20	30.14	SW.	Brisk		Par. Cloudy.	Clear.
	3	54	70	29.94	29.94	SW.	Moderate		Cloudy.	Lightly cloudy.
	4	45	50	29.94	30.00	E.	Brisk	.55	Drizzle.	Rain.
	5	40	47	29.95	29.95	E. W.	Moderate		Cloudy.	Cloudy.
	6	44	64	30 00	30.15	W. SW.	do		Clear.	Hazy.
	7	50	52	29.85	29.85	SE.	do	.25	Fog.	Rain.
	8	46	48	29.5[illegible]	29.66	NE. E.	do		Cloudy.	Cloudy.
	9	44	42	29.70	29.73	NE.	do	1.20	Rain.	Cloudy.
⊗	10	40	60	29.90	29.90	W.	do		Clear.	Clear.
	11	50	68	29.80	29.84	W.	Brisk		Clear.	Clear.
	12	50	66	29.85	29.85	E NW.	Moderate	.24	Clear.	Rain.
	13	44	46	29.90	29.93	E.	do		Cloudy.	Drizzle.
	14	40	56	29.75	29.80	NW.	do	.50	Rain.	Clear.
	15	42	64	29.90	29.95	W.	Brisk		Par. cloudy.	Flying clouds.
	16	43	59	30.05	30.10	W.	Moderate		Par. cloudy.	Partially cloudy.
	17	45	44	30.14	30.14	E.	Blust'ring		Rain---hail.	Rain.
☾	18	41	44	29.91	29.90	NE.	Brisk		Rain.	Cloudy.
	19	41	46	29.68	29.60	NE.	Moderate		Cloudy.	Cloudy.
	20	46	61	29.60	29.65	W.	do		Par. Cloudy.	Partially cloudy.
	21	46	64	29.95	30.06	E. SE.	do		Clear.	Clear.
	22	46	74	29.96	29.85	SW.	do		Clear.	Clear.
	23	62	73	29.70	29.85	W.	do		Clear.	Clear.
⊛	24	59	73	30.00	30.00	SE. S.	do		Cloudy.	Lightly cloudy.
	25	55	75	29.85	29.85	S. W.	do		Fog.	Clear.
	26	61	81	29.64	29.50	SW.	Brisk	.35	Clear.	Showery.
	27	49	60	29.45	29.45	W.	do		Clear.	Flying clouds.
	28	44	50	29.60	29.65	W.	do		Par. cloudy.	Partially cloudy.
	29	40	64	29 85	29.80	W.	do		Clear.	Clear.
	30	40	66	29.80	29.80	SE. SW.	Moderate		Clear.	Lightly cloudy.
		45.83	59.20	29.85	29.87			3.09		

Thermometer. **Barometer.**

Maximum 81.00 on 26th. Minimum 28.00 on 1st. { Mean, 52.515 | Max. 30.30 on 1st. Min. 29.45 on 27th. { Mean 29.86

MAY, 1842.

Moon.	Days.	Therm. Sun Rise.	Therm. 2 P.M.	Baromtr. Sun Rise.	Baromtr. 2 P.M.	Wind. Direction.	Wind. Force.	Water Fallen in rain	State of the Weather, and Remarks.	
	1	48°	73°	29.67	29.50	W.	Brisk		Fog.	Clear.
☽	2	48	50	29.50	29.50	NW.	Moderate	.30	Cloudy.	Showery.
	3	45	47	29.70	29.75	NW. SE.	do	.56	Cloudy.	Rain.
	4	45	56	29.75	29.75	W. NW.	do	.06	Cloudy.	Shower.
	5	42	65	30.10	30.10	NW.	Calm		Clear.	Clear.
	6	45	72	30.06	29.90	SW.	Brisk		Clear.	Clear.
	7	50	64	29.90	30.14	W.	Moderate		Clear.	Clear.
	8	41	67	29.95	29.80	W.	Brisk		Foggy.	Lightly cloudy.
	9	43	49	29.70	29.70	NW.	do		Clear.	Flying clouds.
⊗	10	46	71	29.80	29.70	W.	do		Cloudy.	Cloudy.
	11	56	81	29.66	29.60	SW.	do		Par. cloudy.	Clear.
	12	52	65	29.75	29.80	W.	do		Clear.	Clear.
	13	47	75	29.85	29.70	SW. S.	Moderate		Clear.	Lightly cloudy.
	14	45	64	29.90	30.00	NW.	do		Clear.	Clear.
	15	43	62	29.90	29.85	W. SE.	do		Clear.	Cloudy.
	16	42	72	29.85	29.86	W. SW.	do		Clear.	Clear.
☾	17	56	79	30.00	30.03	W.	do		Clear.	Hazy.
	18	56	75	30.10	30.10	SW.	do		Cloudy.	Cloudy.
	19	56	76	30.00	29.94	SW	Brisk		Cloudy.	Clear.
	20	47	42	30.05	30.20	SE. NE.	do	1.65	Rain.	Rain.
	21	41	63	30.20	30.15	E.	Moderate		Cloudy.	Lightly cloudy.
	22	50	60	29.95	29.30	SW.	do	.10	Cloudy.	Cloudy---rain.
	23	58	69	29.70	29.74	W.	do		Cloudy.	Flying clouds.
⊛	24	56	66	29.90	29.90	SE.	do	.20	Fog.	Rain.
	25	55	69	29.80	29.83	NW. W.	do		Cloudy.	Flying clouds.
	26	53	73	29.85	29.90	SW.	do	.65	Clear.	Lig't cl'dy---rain.
	27	56	67	29.84	29.75	E.	do	.10	Rain.	Cloudy.
	28	57	74	29.80	29.80	W.	do		Clear.	Clear.
	29	57	76	29.80	29.65	W.	do		Par. cloudy.	Par. cloudy.
	30	64	71	29.56	29.56	W.	do	.45	Showery.	Showery.
	31	54	69	29.65	29.74	W.	do		Clear.	Clear.
		50.13	66.58	29.85	29.81			4.07		

Thermometer. **Barometer.**

Maximum 81 on 11th. Minimum 41 on 8th and 21st. { Mean 58.355 | Max. 30.20 on 20th & 21st. Min. 29.30 on 22nd. { Mean 29.83